Microsoft Azure

The only consistent and comprehensive hybrid cloud

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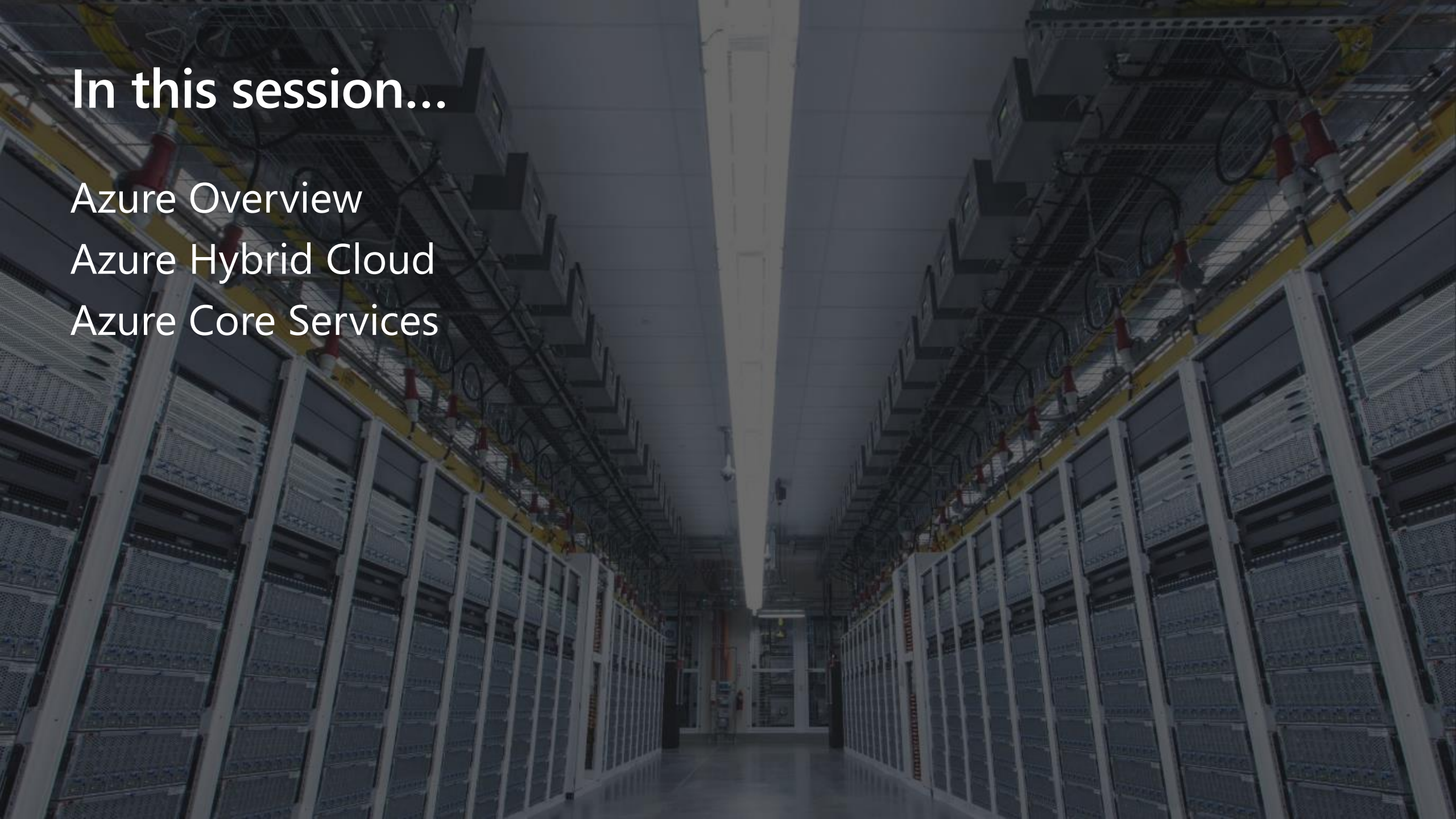


In this session…

Azure Overview
Azure Hybrid Cloud
Azure Core Services

Microsoft

But first …

Some Trivia!

Microsoft

What's the oldest running Cloud Service from Microsoft ?
(Hint, you're a consumer of it)

Windows Update

Windows Update was introduced as an Internet web site with the launch of Windows 95.

https://en.wikipedia.org/wiki/Windows_Update

Microsoft

How do we cool our gen. 4 Azure Data Centers to 69 degrees ?

Adiabatic Cooling

We use adiabatic cooling to bring in outside air at ambient temperature, filter it (get rid of bugs and dust), run it across a wet sponge-like wall, and regulate the temperature.

http://www.iconstructions.be/Blog/pdc-2009-inside-windows-azure-container

Microsoft

How many times could the Microsoft Fiber Optic Network that connects our Azure data centers stretch to the moon and back?

3

We now have 2M+ miles of *private fiber* between our Azure data centers

Microsoft

Can you tour a Microsoft Azure datacenter?

YES!

Ask our competition if you can tour theirs …

Worldwide Tour & Experience Locations

For more detail: http://aka.ms/wwdep

Microsoft

Why did we experiment with an underwater datacenter? (Project Natick)

½ of the worlds' population lives within 50 miles of the sea

Makes connecting to our customers as short as possible…


Microsoft
Microsoft


Microsoft


GREEN MARINE
ENERGY SUPPORT SERVICES

Microsoft

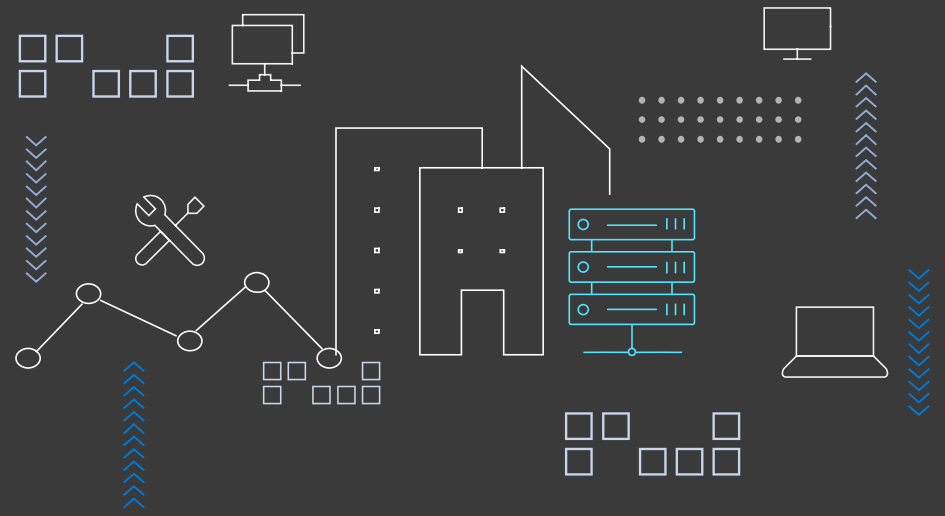
In a typical raised floor data center, how much does one of those white tiles cost?

$60 - $70

Each (in bulk)

Why spend six digits on your floor alone?

On-premise vs Cloud mindset



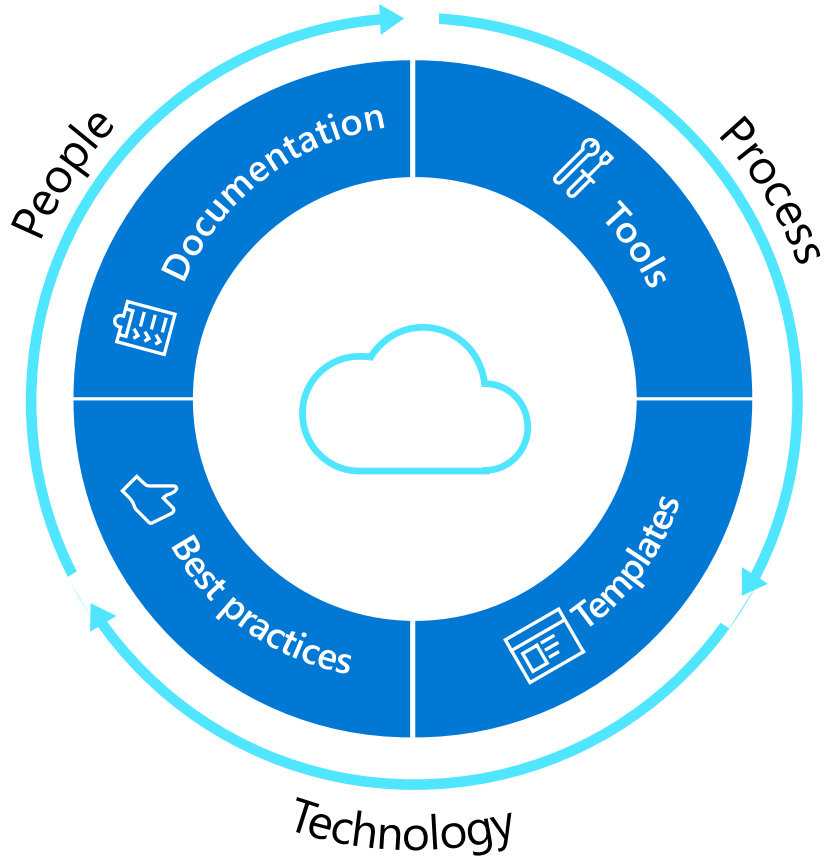
On-premises Mindset

- Provision for peak demand
- Scale-up versus scale-out mentality
- Virtual machines
- Always-on
- Fixed in size
- Order 3 months before you need it
- Hording mentality because resources were scarce

Cloud Mindset

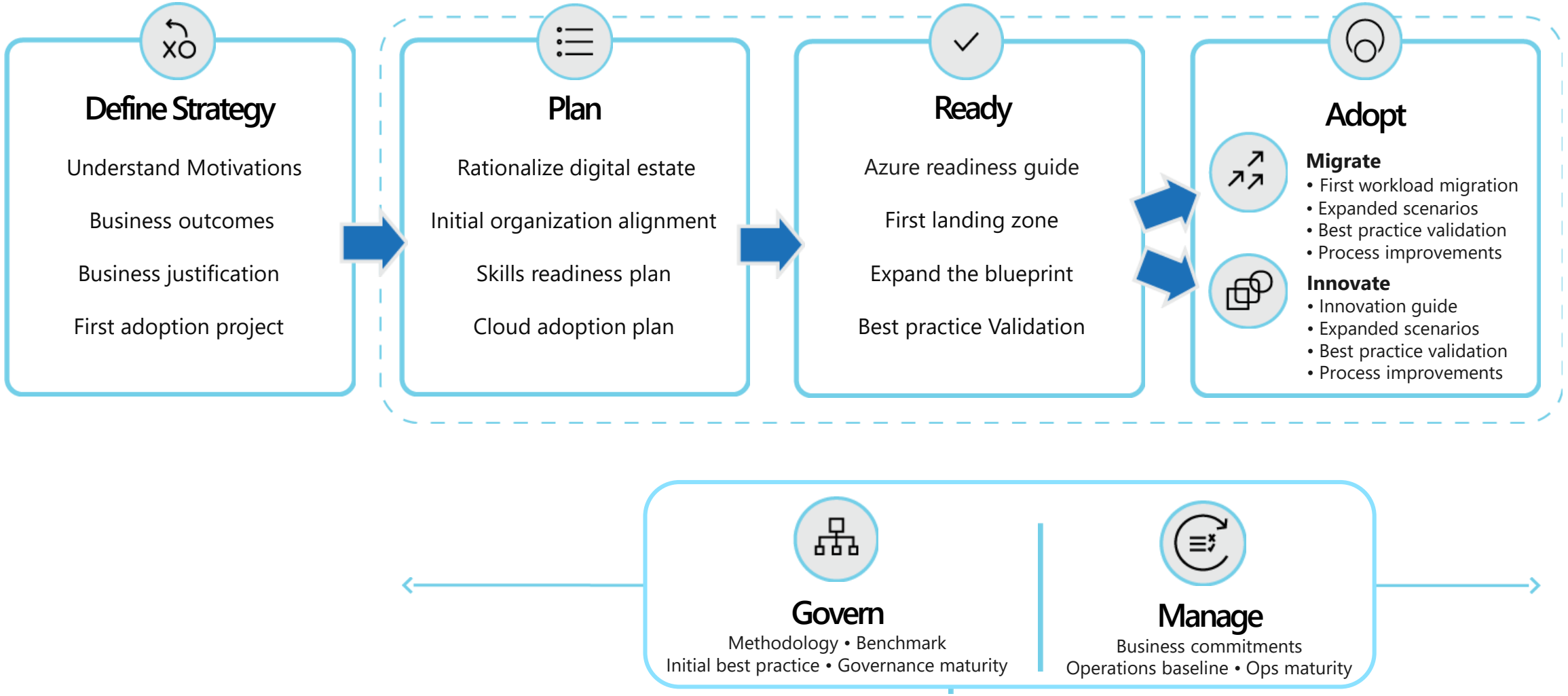
- Think about usage versus provisioning
- Automate everything
- Secure by design, and assume breach
- Optimize everything, automate sprawl reduction
- Pause and Freeze as needed
- Resilient and Geo available
- No requirement for lead time

Microsoft Cloud Adoption Framework for Azure



Align **business, people and technology strategy** to achieve business goals with **actionable, efficient, and comprehensive** guidance to deliver fast results with control and stability.

Microsoft Cloud Adoption Framework for Azure



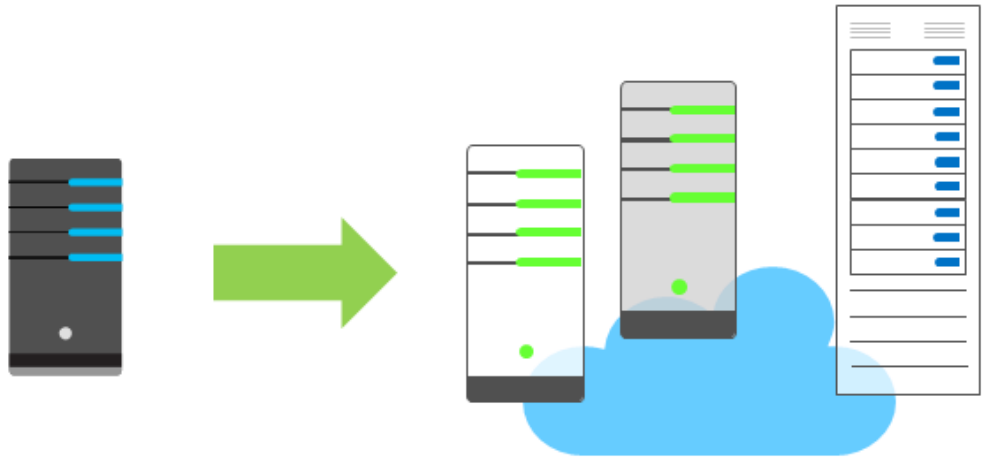
What is Microsoft Azure?


Microsoft
Microsoft Azure Video

Microsoft Azure is an ever-expanding set of cloud services to help your organization meet your business challenges. It's the freedom to build, manage, and deploy applications on a massive, global network using your favorite tools and frameworks.

Economies of scale

- The concept of *economies of scale* is the ability to do things less expensively and more efficiently when operating at a larger scale in comparison to operating at a smaller scale.



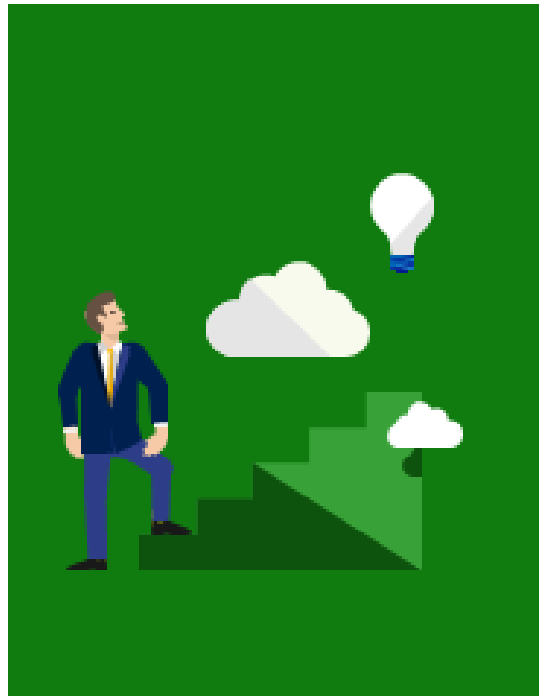
- Cloud providers such as Microsoft, Google, and Amazon Web Services (AWS) are very large businesses, and thus can leverage the benefits of economies of scale and then pass those benefits on to their customers.

CapEx vs. OpEx

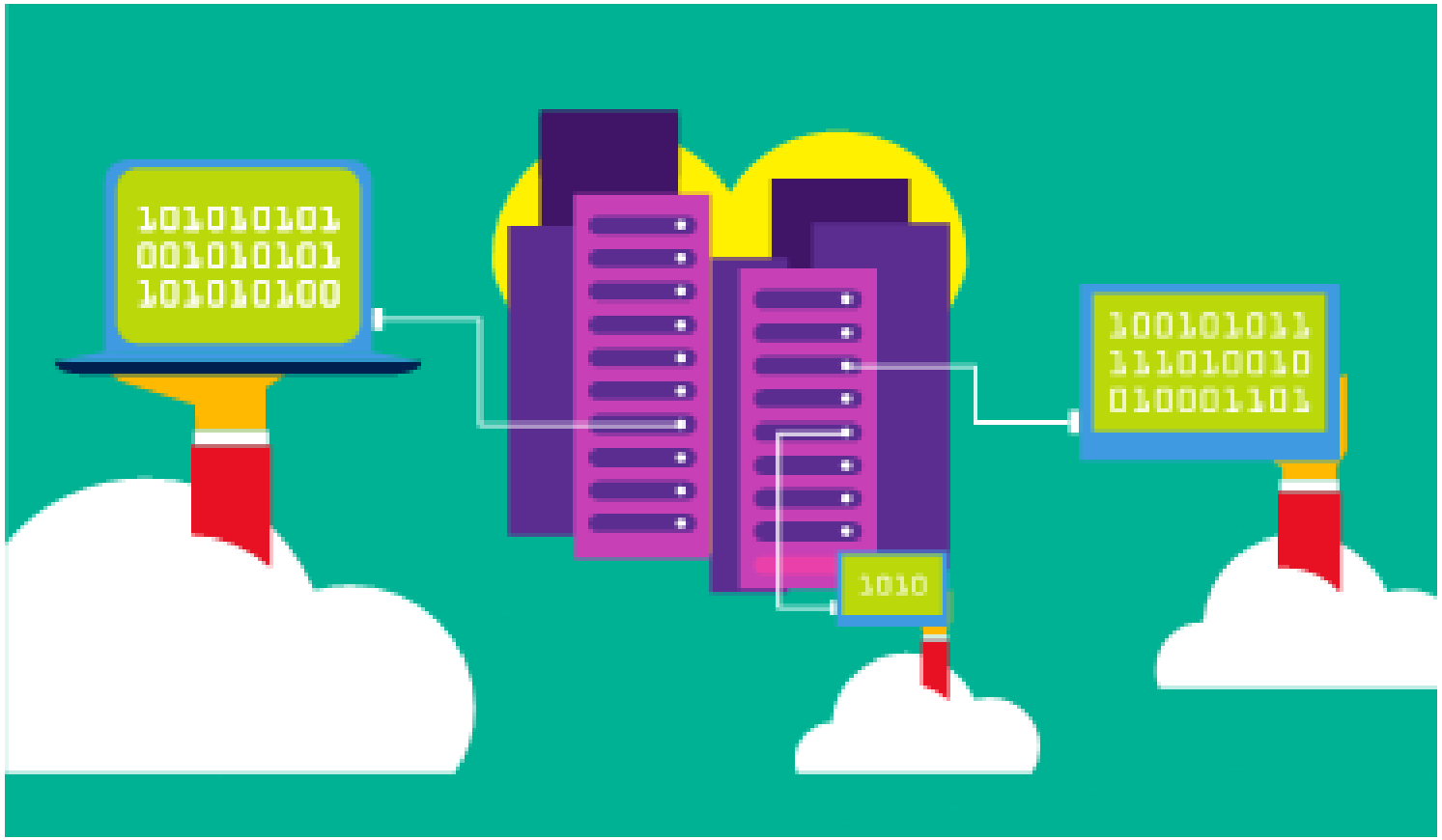
- *Capital Expenditure (CapEx)* is the spending of money on physical infrastructure up front, and then deducting that expense from your tax bill over time. CapEx is an upfront cost which has a value that reduces over time.
- *Operational Expenditure (OpEx)* is spending money on services or products and being billed for them immediately. You can deduct this expense from your tax bill in the same year. There is no upfront cost, you pay for a service or product as you use it.

Consumption-based model

Users only pay for the resources they use



Types of cloud models

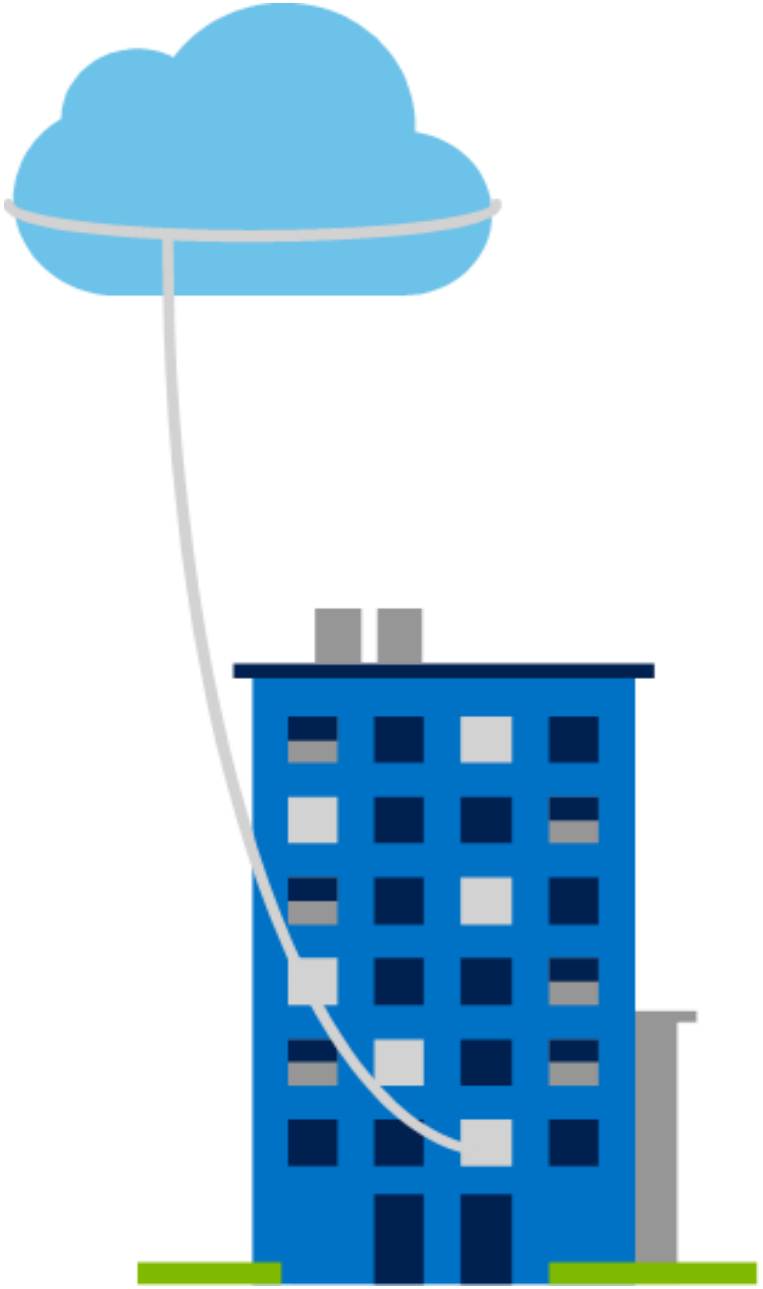


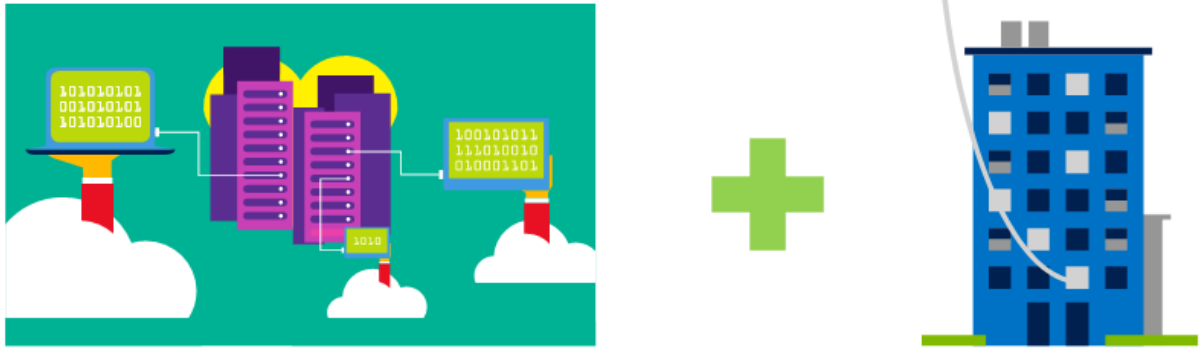
Public cloud

A *public cloud* is owned by a cloud services provider (also known as a *hosting provider*). It provides resources and services to multiple organizations and users who connect to the cloud service via a secure network connection, typically over the internet

Private cloud

A *private cloud* is owned and operated by the organization that uses the resources from that cloud. They create a cloud environment in their own datacenter and provide self-service access to compute resources to users within their organization. The organization remains the owner, entirely responsible for the operation of the services they provide.





A *hybrid cloud* combines both public and private clouds, allowing you to run your applications in the most appropriate location

Hybrid cloud

Cloud model comparison

Public cloud:

- No CapEx. You don’t have to buy a new server to scale up.
- Agility. Applications can be made accessible quickly, and deprovisioned whenever needed.
- Consumption-based model. Organizations pay only for what they use, and operate under an OpEx model.

Private cloud:

- Control. Organizations have complete control over resources.
- Security. Organizations have complete control over security.

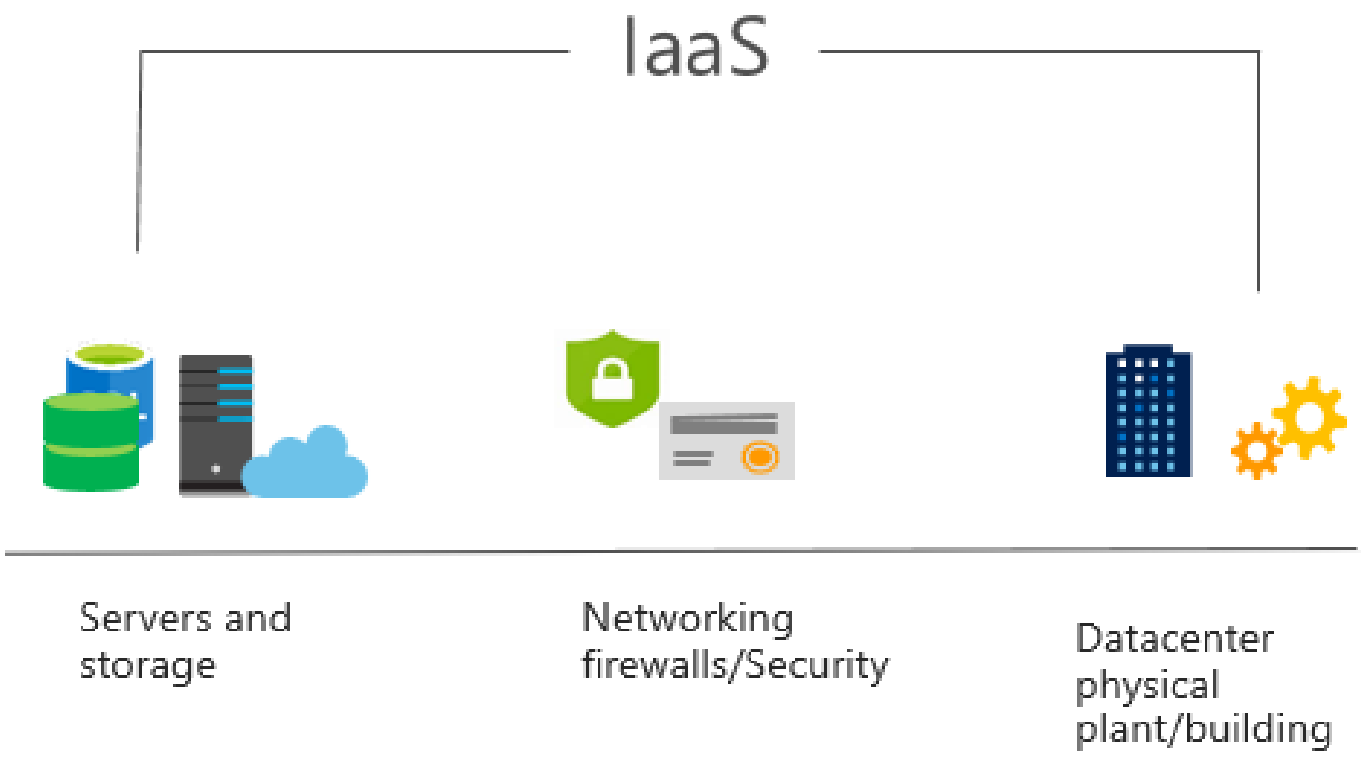
Hybrid cloud:

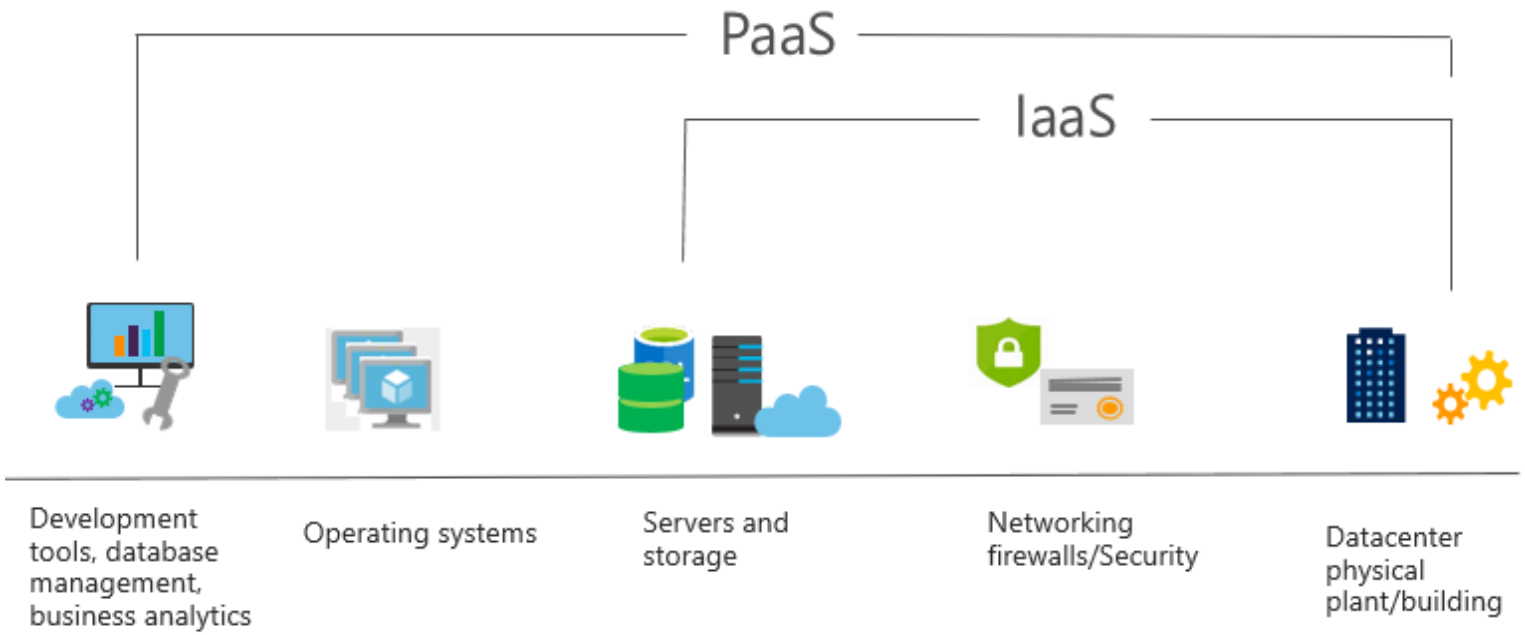
- Flexibility. The most flexible scenario. With a hybrid cloud setup, an organization can determine whether to run their applications in a private cloud or in a public cloud.
- Compliance. Organizations maintain the ability to comply with strict security, compliance, or legal requirements as needed.

Types of cloud services

IaaS

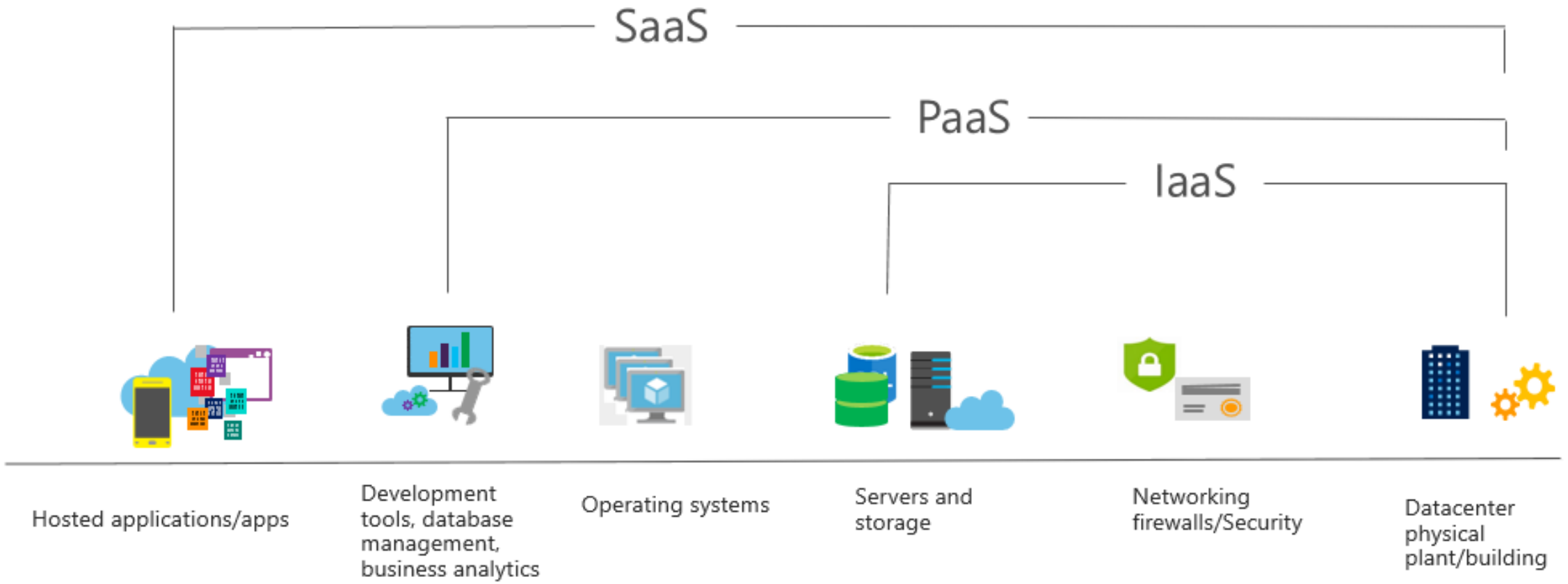
IaaS is the most basic category of cloud computing services. With IaaS, you consume IT infrastructure servers, and virtual machines (VMs), storage, networks, and operating systems from a cloud provider on a pay-as-you-go basis. It's an instant computing infrastructure, provisioned and managed over the Internet.





PaaS

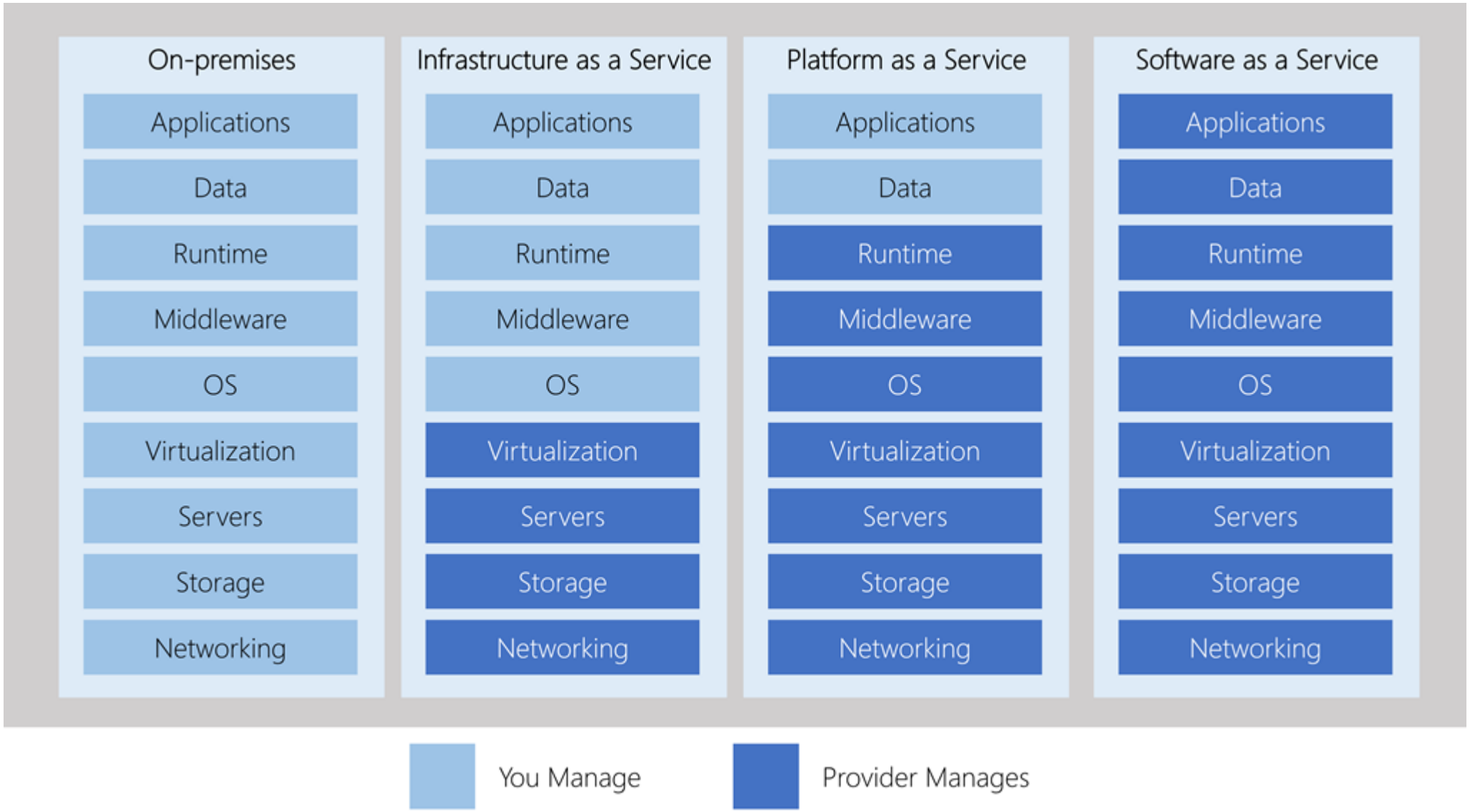
PaaS provides an environment for building, testing, and deploying software applications. The goal of PaaS is to help create an application as quickly as possible without having to focus on managing the underlying infrastructure.



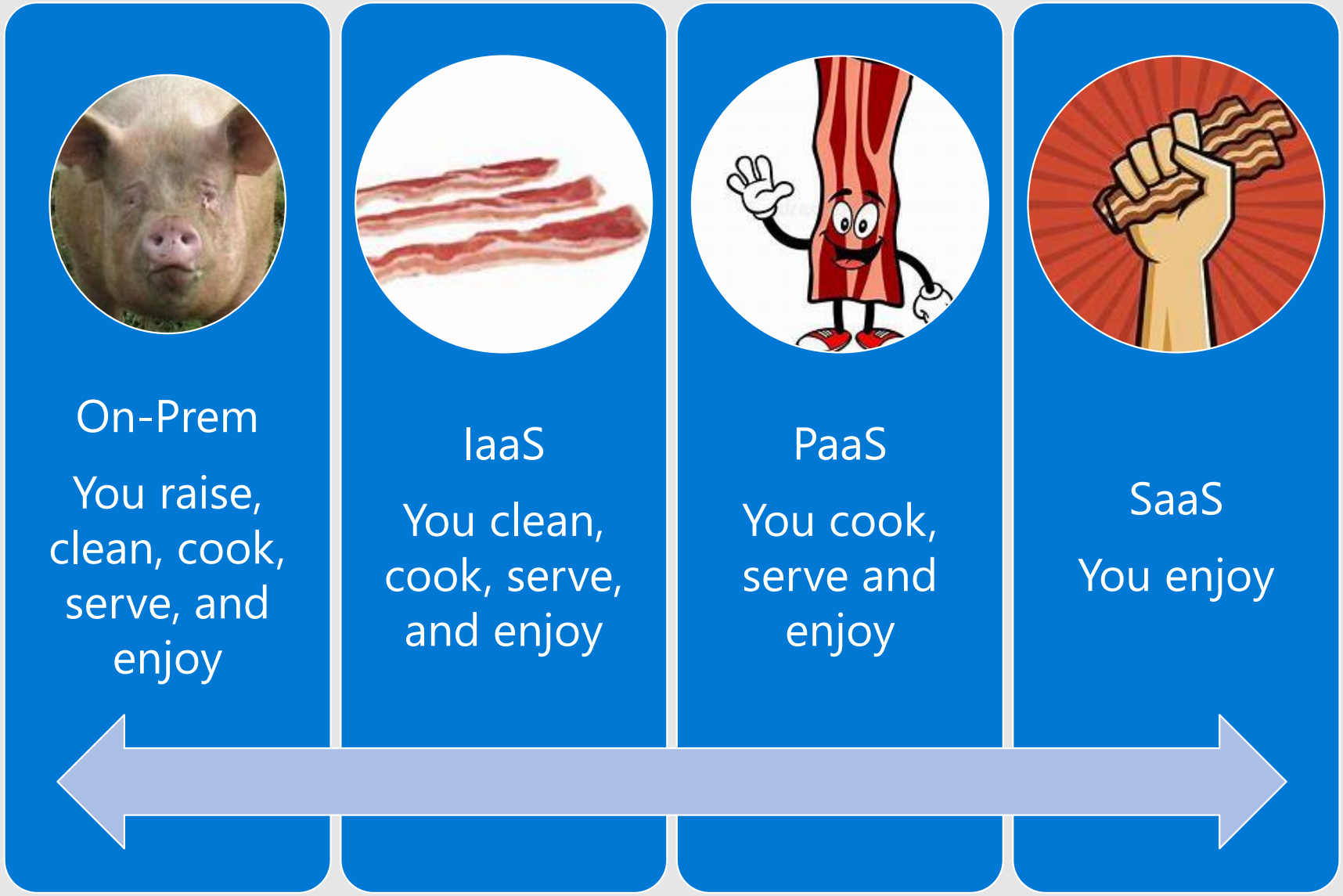
SaaS

SaaS is software that is centrally hosted and managed for the end customer. It allows users to connect to and use cloud-based apps over the internet. Common examples are email, calendars, and office tools such as Microsoft Office 365.

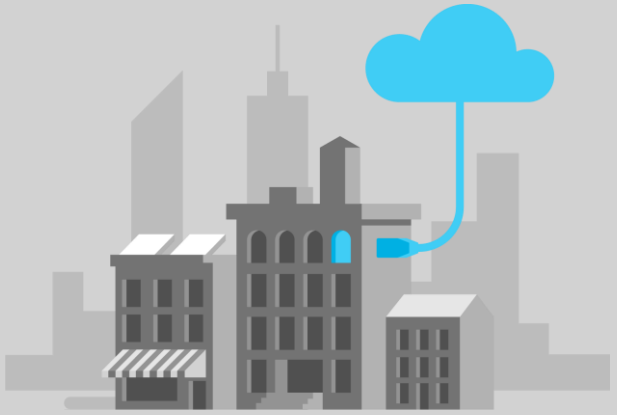
Cloud Computing Models

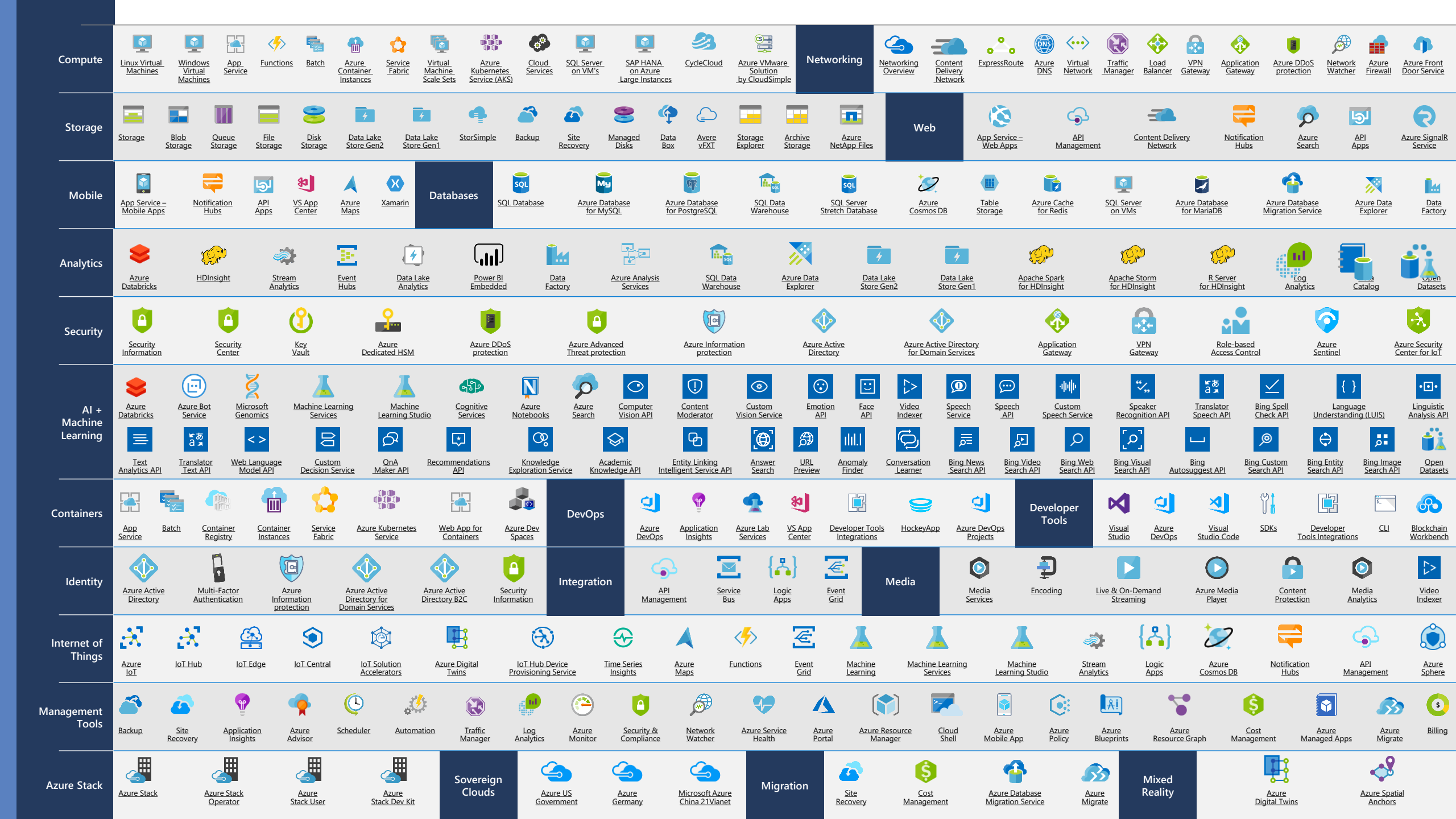


It’s just like bacon …



What does Azure look like?




Compute
Linux Virtual Machines
Windows Virtual Machines
App Service
Functions
Batch
Azure Container Instances
Service Fabric
Virtual Machine Scale Sets
Azure Kubernetes Service (AKS)
Cloud Services
SQL Server on VM's
SAP HANA on Azure Large Instances
CycleCloud
Azure VMware Solution by CloudSimple
Networking
Networking Overview
Content Delivery Network
ExpressRoute
Azure DNS
Virtual Network
Traffic Manager
Load Balancer
VPN Gateway
Application Gateway
Azure DDoS protection
Network Watcher
Azure Firewall
Azure Front Door Service
Storage
Storage
Blob Storage
Queue Storage
File Storage
Disk Storage
Data Lake Store Gen2
Data Lake Store Gen1
StorSimple
Backup
Site Recovery
Managed Disks
Data Box
Avere vFXT
Storage Explorer
Archive Storage
Azure NetApp Files
Web
App Service – Web Apps
API Management
Content Delivery Network
Notification Hubs
Azure Search
API Apps
Azure SignalR Service
Mobile
App Service – Mobile Apps
Notification Hubs
API Apps
VS App Center
Azure Maps
Xamarin
Databases
SQL Database
Azure Database for MySQL
Azure Database for PostgreSQL
SQL Data Warehouse
SQL Server Stretch Database
Azure Cosmos DB
Table Storage
Azure Cache for Redis
SQL Server on VMs
Azure Database for MariaDB
Azure Database Migration Service
Azure Data Explorer
Data Factory
Analytics
Azure Databricks
HDInsight
Stream Analytics
Event Hubs
Data Lake Analytics
Power BI Embedded
Data Factory
Azure Analysis Services
SQL Data Warehouse
Azure Data Explorer
Data Lake Store Gen2
Data Lake Store Gen1
Apache Spark for HDInsight
Apache Storm for HDInsight
R Server for HDInsight
Log Analytics
Data Catalog
Open Datasets
Security
Security Information
Security Center
Key Vault
Azure Dedicated HSM
Azure DDoS protection
Azure Advanced Threat protection
Azure Information protection
Azure Active Directory
Azure Active Directory for Domain Services
Application Gateway
VPN Gateway
Role-based Access Control
Azure Sentinel
Azure Security Center for IoT
AI + Machine Learning
Azure Databricks
Azure Bot Service
Microsoft Genomics
Machine Learning Services
Machine Learning Studio
Cognitive Services
Azure Notebooks
Azure Search
Computer Vision API
Content Moderator
Custom Vision Service
Emotion API
Face API
Video Indexer
Speech Service
Speech API
Custom Speech Service
Speaker Recognition API
Translator Speech API
Bing Spell Check API
Language Understanding (LUIS)
Linguistic Analysis API
Text Analytics API
Translator Text API
Web Language Model API
Custom Decision Service
QnA Maker API
Recommendations API
Knowledge Exploration Service
Academic Knowledge API
Entity Linking Intelligent Service API
Answer Search
URL Preview
Anomaly Finder
Conversation Learner
Bing News Search API
Bing Video Search API
Bing Web Search API
Bing Visual Search API
Bing Autosuggest API
Bing Custom Search API
Bing Entity Search API
Bing Image Search API
Open Datasets
Containers
App Service
Batch
Container Registry
Container Instances
Service Fabric
Azure Kubernetes Service
Web App for Containers
Azure Dev Spaces
DevOps
Azure DevOps
Application Insights
Azure Lab Services
VS App Center
Developer Tools Integrations
HockeyApp
Azure DevOps Projects
Developer Tools
Visual Studio
Azure DevOps
Visual Studio Code
SDKs
Developer Tools Integrations
CLI
Blockchain Workbench
Identity
Azure Active Directory
Multi-Factor Authentication
Azure Information protection
Azure Active Directory for Domain Services
Azure Active Directory B2C
Security Information
Integration
API Management
Service Bus
Logic Apps
Event Grid
Media
Media Services
Encoding
Live & On-Demand Streaming
Azure Media Player
Content Protection
Media Analytics
Video Indexer
Internet of Things
Azure IoT
IoT Hub
IoT Edge
IoT Central
IoT Solution Accelerators
Azure Digital Twins
IoT Hub Device Provisioning Service
Time Series Insights
Azure Maps
Functions
Event Grid
Machine Learning
Machine Learning Services
Machine Learning Studio
Stream Analytics
Logic Apps
Azure Cosmos DB
Notification Hubs
API Management
Azure Sphere
Management Tools
Backup
Site Recovery
Application Insights
Azure Advisor
Scheduler
Automation
Traffic Manager
Log Analytics
Azure Monitor
Security & Compliance
Network Watcher
Azure Service Health
Azure Portal
Azure Resource Manager
Cloud Shell
Azure Mobile App
Azure Policy
Azure Blueprints
Azure Resource Graph
Cost Management
Azure Managed Apps
Azure Migrate
Billing
Azure Stack
Azure Stack
Azure Stack Operator
Azure Stack User
Azure Stack Dev Kit
Sovereign Clouds
Azure US Government
Azure Germany
Microsoft Azure China 21Vianet
Migration
Site Recovery
Cost Management
Azure Database Migration Service
Azure Migrate
Mixed Reality
Azure Digital Twins
Azure Spatial Anchors

Azure covers 91 compliance offerings

Azure has the deepest and most comprehensive compliance coverage in the industry

Global

- ISO 27001:2013
- ISO 27017:2015
- ISO 27018:2014
- ISO 22301:2012
- ISO 9001:2015
- ISO 20000-1:2011
- SOC 1 Type 2
- SOC 2 Type 2
- SOC 3
- CIS Benchmark
- CSA STAR Certification
- CSA STAR Attestation
- CSA STAR self-assessment
- WCAG 2.0 (ISO 40500:2012)

US Gov

- FedRAMP high
- FedRAMP moderate
- EAR
- ITAR
- DoD DISA SRG Level 5
- DoD DISA SRG Level 4
- DoD DISA SRG Level 2
- DFARS
- DoE 10 CFR Part 810
- NIST SP 800-171
- NIST CSF
- Section 508 VPATs
- FIPS 140-2
- CJIS
- IRS 1075
- CNSSI 1253

Industry

- PCI DSS Level 1
- GLBA (US)
- FFIEC (US)
- Shared assessments (US)
- SEC 17a-4 (US)
- CFTC 1.31 (US)
- FINRA 4511 (US)
- SOX (US)
- 23 NYCRR 500 (US)
- OSFI (Canada)
- FCA + PRA (UK)
- APRA (Australia)
- FINMA (Switzerland)
- FSA (Denmark)
- RBI + IRDAI (India)
- MAS + ABS (Singapore)
- NBB + FSMA (Belgium)
- AFM + DNB (Netherlands)
- AMF + ACPR (France)
- KNF (Poland)
- European Banking Authority (EBA)
- FISC (Japan)
- HIPAA BAA (US)
- HITRUST certification
- GxP (FDA 21 CFR Part 11)
- MARS-E (US)
- NHS IG Toolkit (UK)
- NEN 7510:2011 (Netherlands)
- FERPA (US)
- CDSA
- MPAA (US)
- FACT (UK)
- DPP (UK)
- TISAX (Germany)

Regional

- Argentina PDPA
- Australia IRAP Unclassified
- Australia IRAP PROTECTED
- Canada Privacy Laws
- China GB 18030:2005
- China DJCP (MLPS) Level 3
- China TRUCS/CCCPPF
- EU EN 301 549
- EU ENISA IAF
- EU model clauses
- EU—US privacy shield
- GDPR
- Germany C5
- Germany IT—Grundschutz workbook
- India MeitY
- Japan CS mark gold
- Japan my number act
- Netherlands BIR 2012
- New Zealand Gov CIO Framework
- Singapore MTCS Level 3
- Spain ENS High
- Spain DPA
- UK cyber essentials plus
- UK G-Cloud
- UK PASF
- Korea K-ISMS
- France HDS

https://aka.ms/AzureCompliance

55 regions worldwide **140** available in 140 countries

* Two Azure Government Secret region locations undisclosed

2M Miles / 3.2M Km
intra-datacenter fiber

72+
Tb per second backbone

150+
datacenters

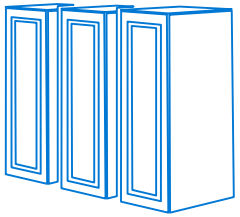
Millions
of servers

DCs and network sites not exhaustive

Regions are not data centers!

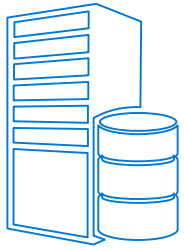
- Our definition of a data center is unlike the usual, customary definition of a data center (pictures coming to explain).
- Each Microsoft Azure Region has at least three (3) physical data centers/buildings, so 54 regions times at least 3 physical data centers/buildings each is 150+ data centers!
- Our competition typically equates one data center per region.
- Each data center is roughly a $1B capex investment, and we can’t build them fast enough.

Datacenter evolution: from 1989 to today



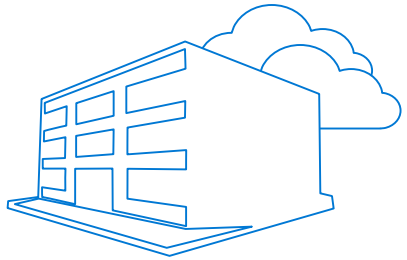
Traditional

2007



Modular

2009



Cloud

Today

Columbia 1 & 2 - 2007


West US2


North Europe


West Europe


West Central

What servers are in Azure?

> Over two Million Servers

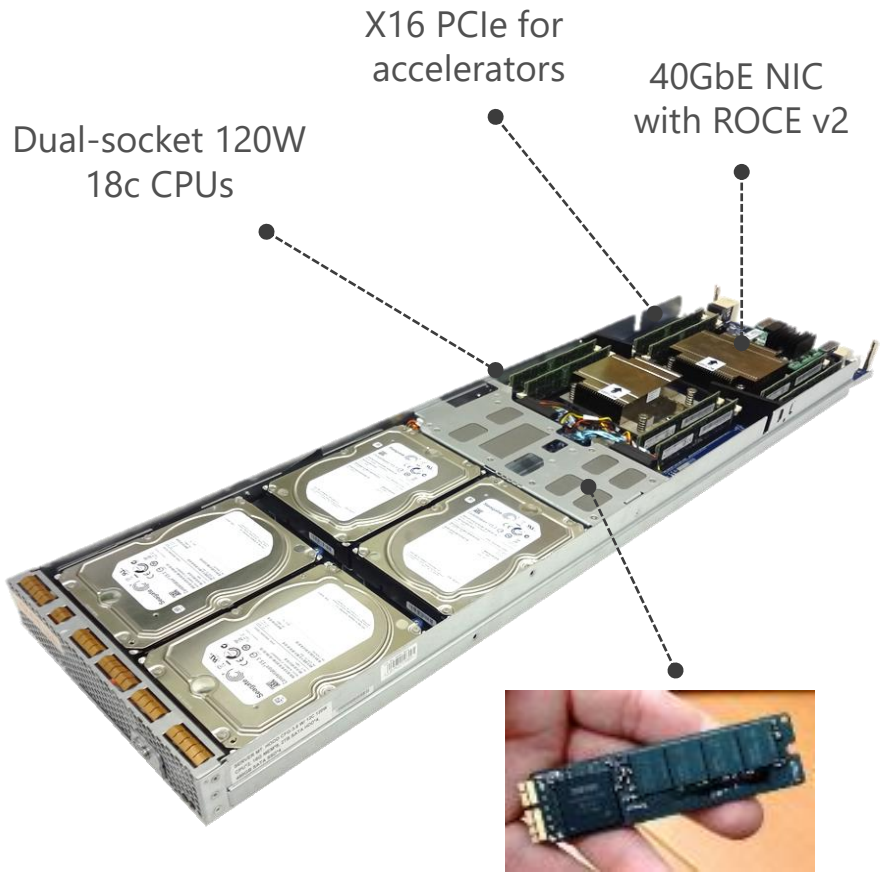
- $15 billion infrastructure investment over 20 years
- Global infrastructure enables 200+ cloud services
- Close collaboration with hardware partners
- Nobody knows an exact server count

Open Compute Project

- Contributed Microsoft Cloud Server Specification
- Hardware Supports Azure, M365 and Bing
- Innovation in modularity, simplicity and efficiency

Driving Customer Benefit

- Deliver hyper-scale learnings
- Drive innovation in the hardware ecosystem
- Microsoft innovations in the hands of customers

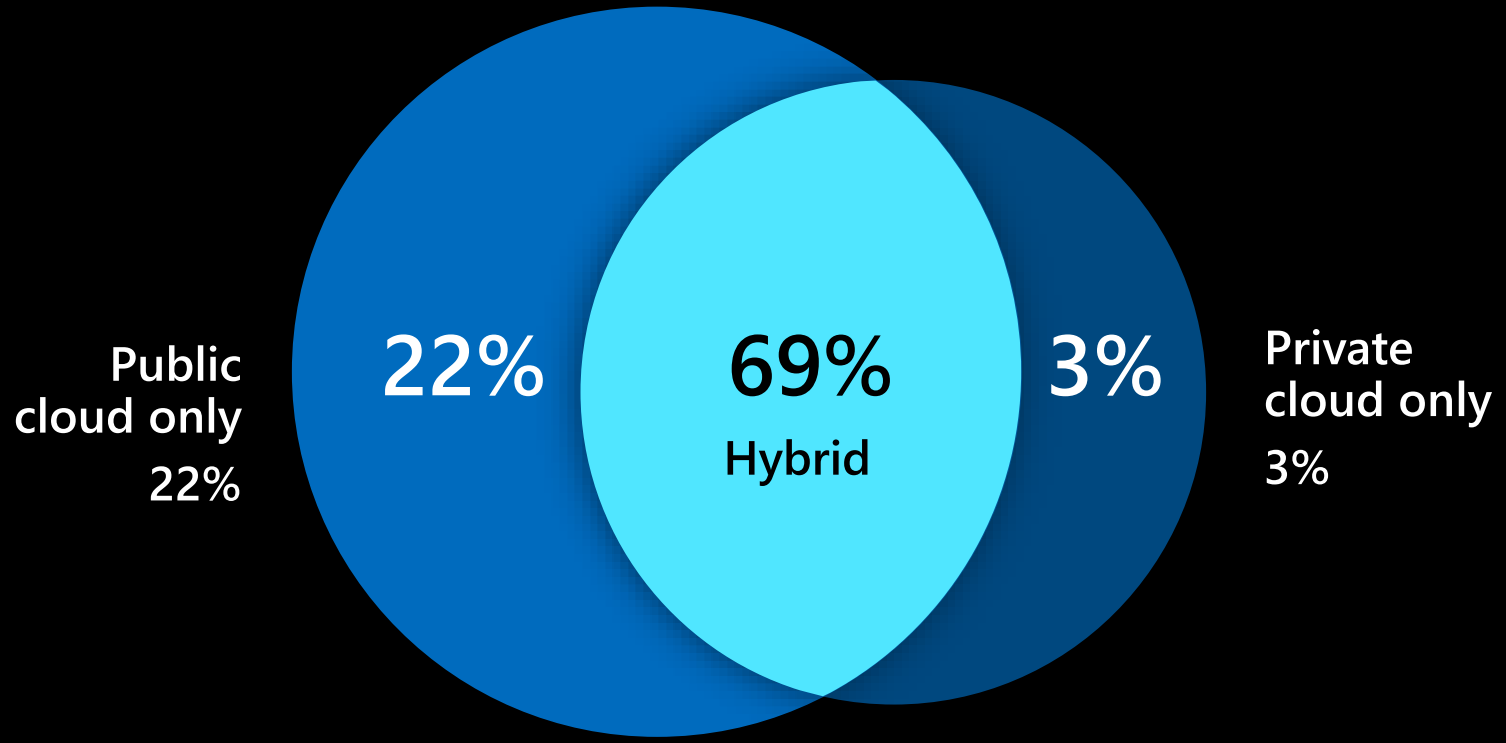


http://www.opencompute.org/wiki/Server/SpecsAndDesigns#Open_CloudServer

Microsoft

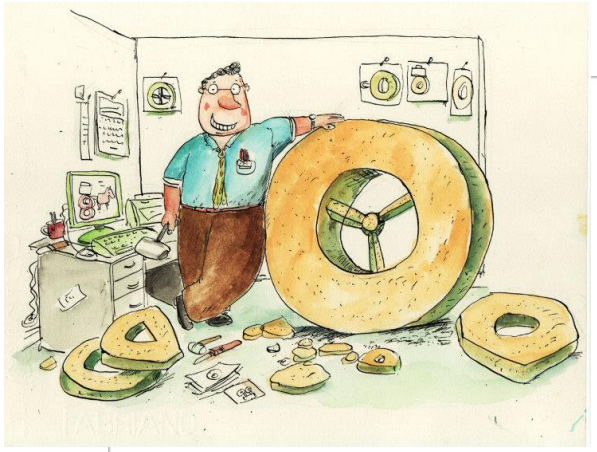
Azure Hybrid

Hybrid is the prevalent strategy

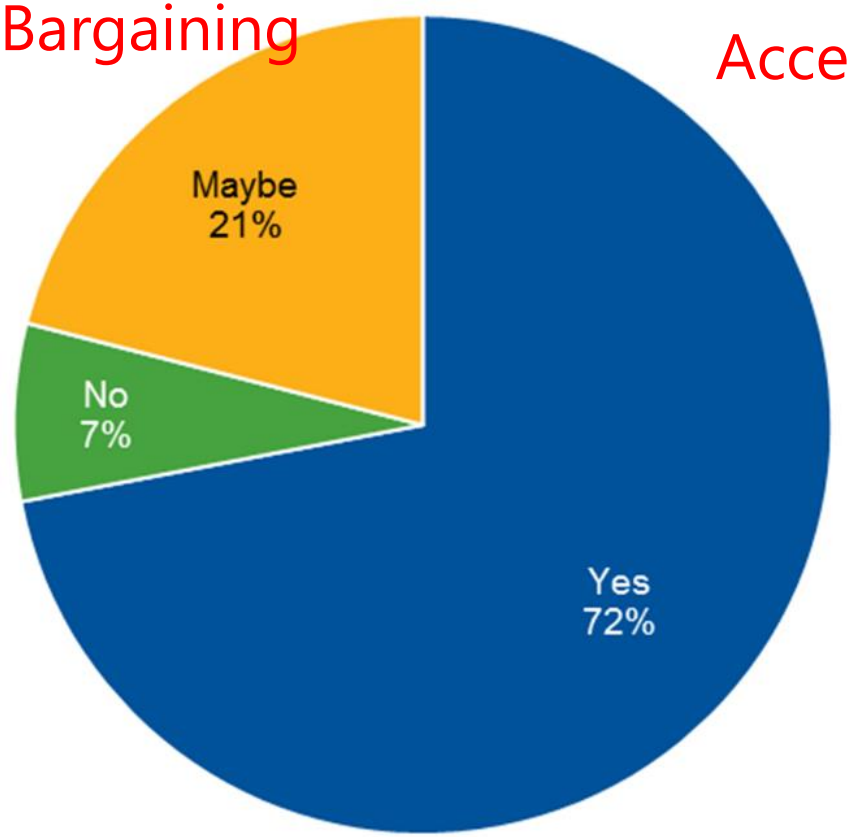


Source: RightScale 2019 State of the Cloud Report from Flexera

What Gartner Says



Bargaining



Acceptance

Denial & Anger

The 5 Stages of Grief & Loss

Q: Will your enterprise be pursuing a hybrid cloud computing strategy by 2018?

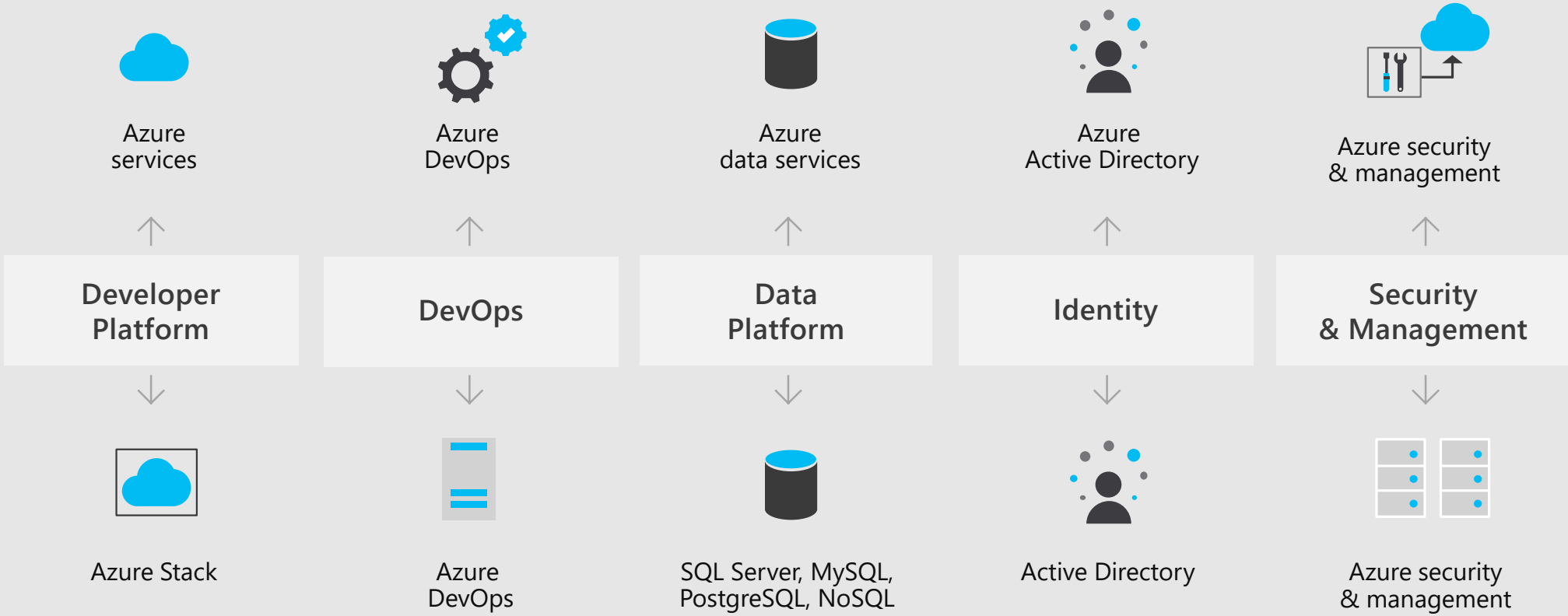
https://www.gartner.com/doc/reprints?id=1-4J25QC3&ct=171023&st=sb

Azure: Hybrid

- Microsoft Azure is the only cloud provider with a true hybrid strategy.
- Microsoft has no competition in this space.
- Microsoft Azure was designed to be hybrid since day 1 (nearly 10 years ago).
- This our biggest competitive advantage, use it to your advantage!

Azure: Hybrid

The only consistent, comprehensive hybrid cloud



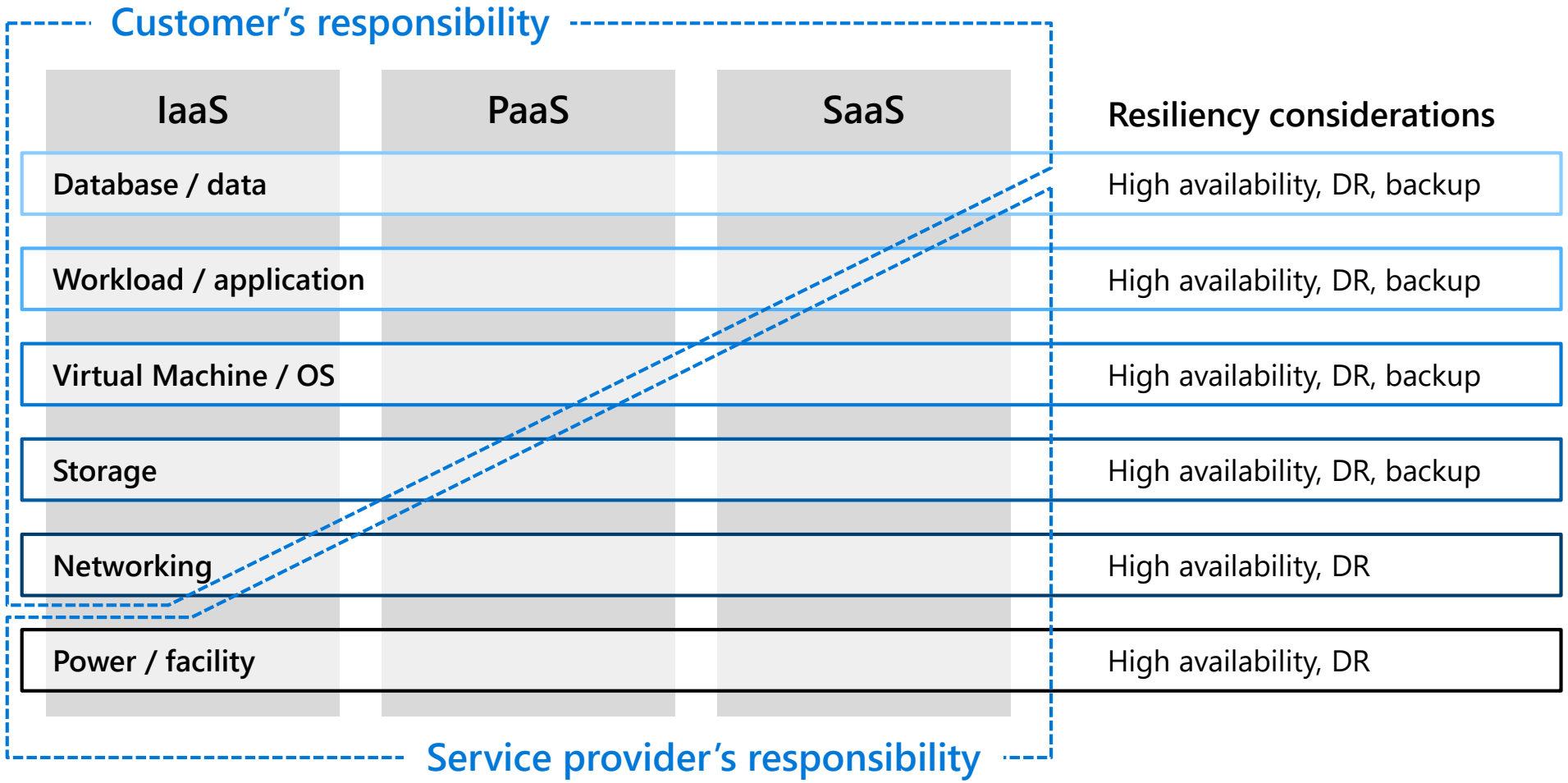
The Azure Infrastructure Platform

Resiliency

- Now that you're moving to the cloud how you design solutions needs to change. *Why?* Every feature in the Azure platform is available to you.
- You are now a storage and network architect, and resiliency must be a discussion at every layer of your solution.
- Just because you move it to the cloud it doesn't mean your solution will have more uptime.

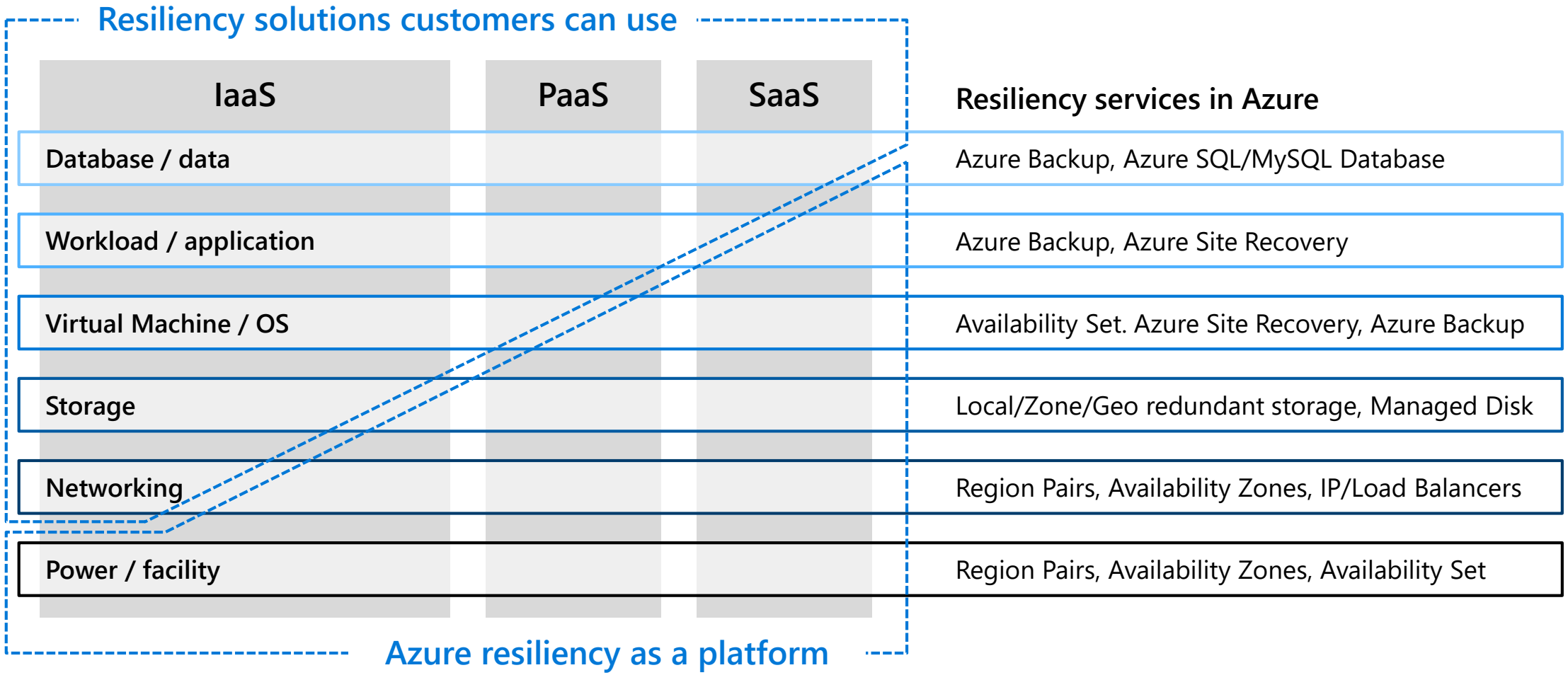
Resiliency in the public cloud

Resiliency is a joint effort between customers and service providers



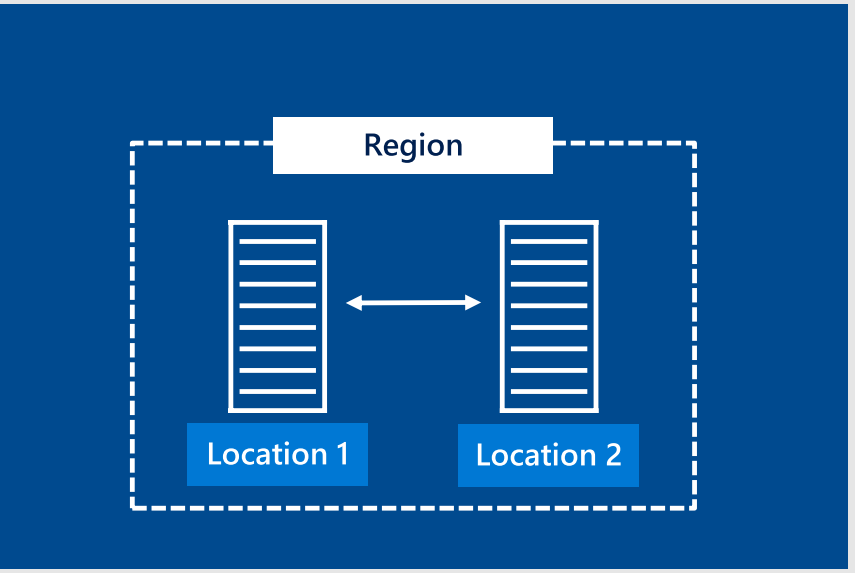
Resiliency in Azure

Azure provides resiliency as a platform and solutions through globe's largest datacenter footprint



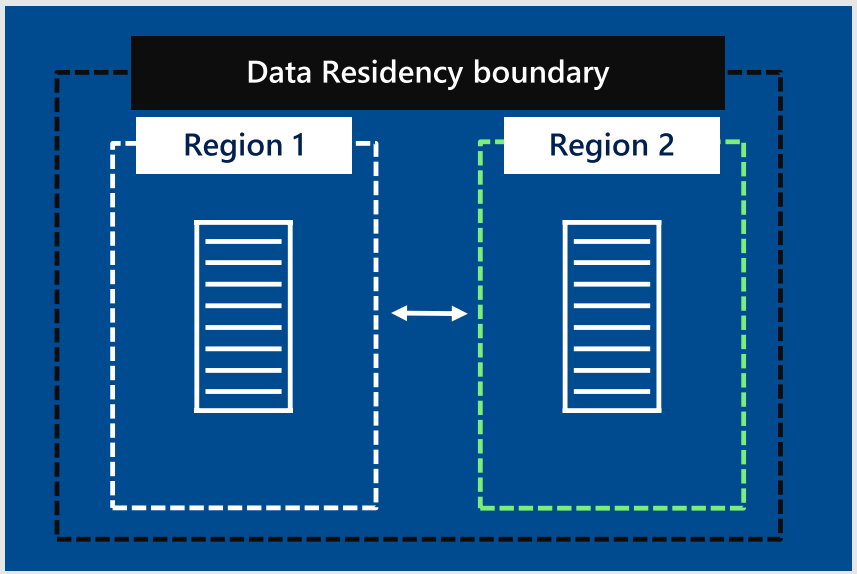
Azure business continuity

From mission critical applications to backup



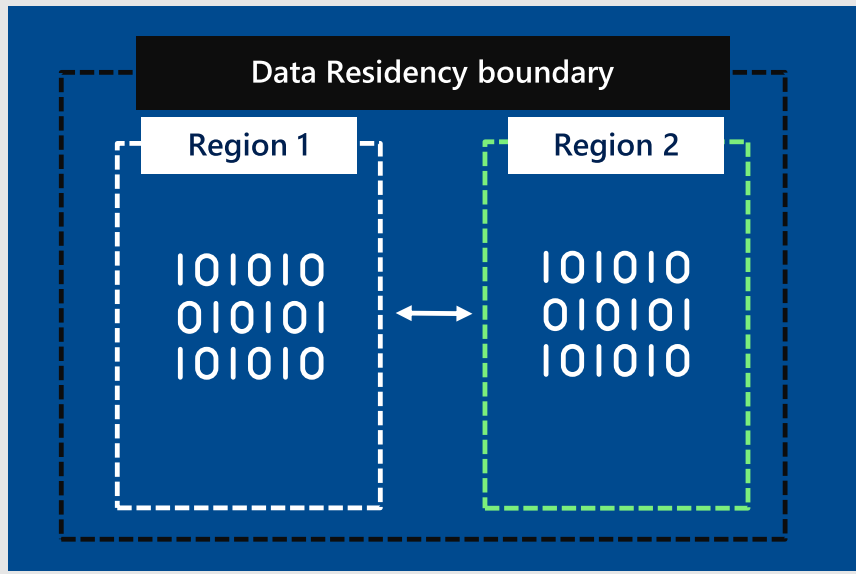
High Availability

Data is replicated to a minimum of one additional location at low latency, so data and application uptime is preserved.



Disaster Recovery

Asynchronous replication from one region to another, with standby VMs in the other region. Azure offers protection between regions within data residency boundaries.



Backup

Data is asynchronously replicated and stored for redundancy purposes with data residency options.

Geographies

A *geography* is a discrete market typically containing two or more regions that preserves data residency and compliance boundaries

Geographies allow customers with specific data-residency and compliance needs to keep their data and applications close

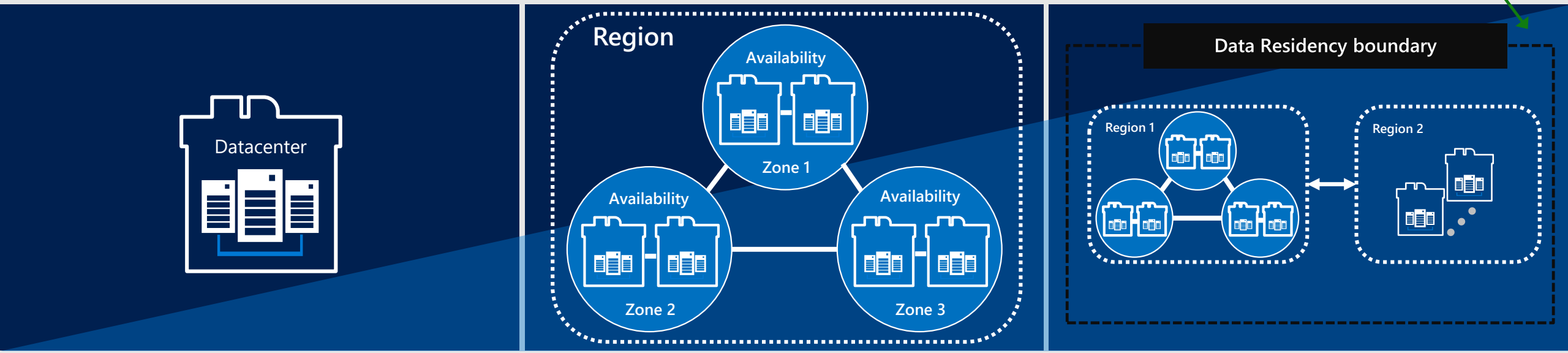
Geographies are broken up into Americas, Europe, Asia Pacific, Middle East, and Africa

Azure Geographies

Geography	Regions
Asia Pacific	East Asia (Hong Kong) Southeast Asia (Singapore)
Australia	Australia Central (Canberra) Australia Central 2 (Canberra) Australia East (New South Wales) Australia Southeast (Victoria)
Brazil	Brazil South (Sao Paulo State)
Canada	Canada Central (Toronto) Canada East (Quebec City)
Europe	North Europe (Ireland) West Europe (Netherlands)
France	France Central (Paris) France South (Marseille)
Germany	Germany North (Berlin) Germany West Central (Frankfurt)
India	Central India (Pune) South India (Chennai) West India (Mumbai)
Japan	Japan East (Tokyo, Saitama) Japan West (Osaka)
Korea	Korea Central (Seoul) Korea South (Busan)
South Africa	South Africa North (Johannesburg) South Africa West (Cape Town)
Switzerland	Switzerland North (Zurich) Switzerland West (Geneva)
United Arab Emirates	UAE Central (Abu Dhabi) UAE North (Dubai)
United Kingdom	UK South (London) UK West (Cardiff)
United States	Central US (Iowa) East US (Virginia) East US 2 (Virginia) North Central US (Illinois) South Central US (Texas) West Central US (Wyoming) West US (California) West US 2 (Washington)

Azure protection options for all scenarios

Introducing Availability Zones, protecting from datacenter level failures



Availability Sets

High Availability protection from hardware failures in a datacenter.

Availability Zones

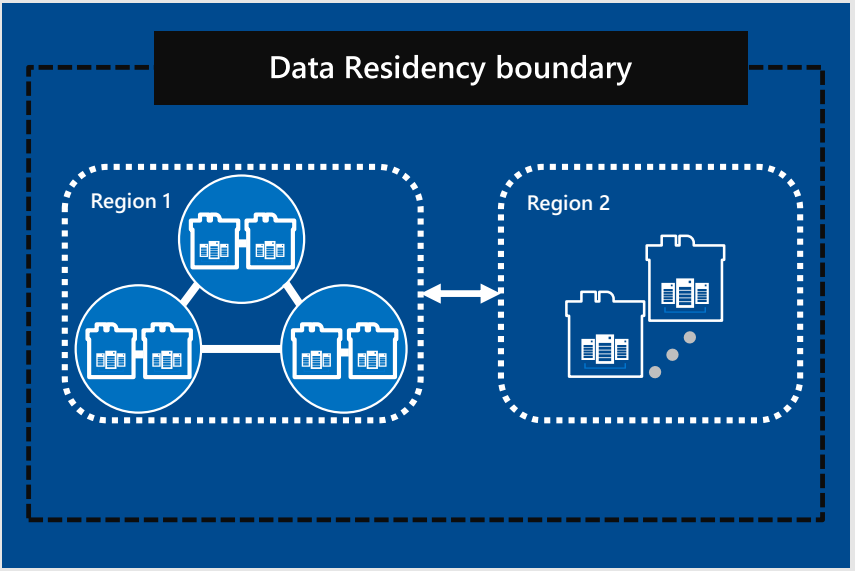
High Availability protection against loss of datacenters. Multiple datacenters per physically separated zone. Each zone features independent network, cooling, and power.

Region Pairs

Protection for your data and applications from the loss of an entire region with Geo-redundant storage (GRS) and Azure Site Recovery.

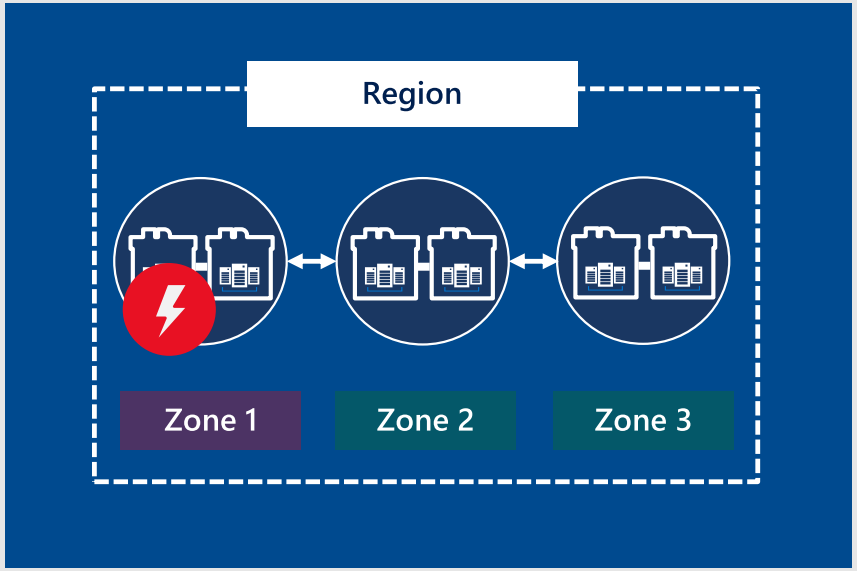
Availability Zones

Part of Azure's native HA/DR solutions, providing protection from datacenter failure



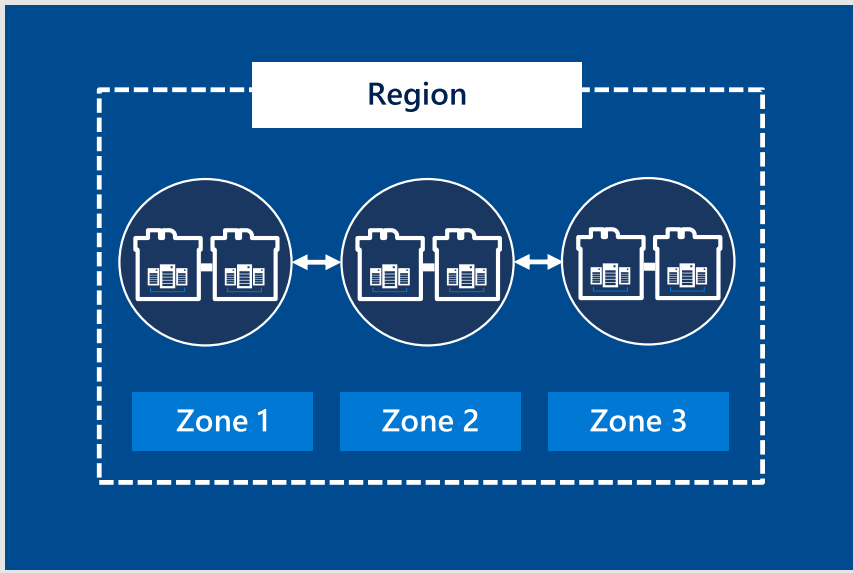
Comprehensive resiliency with Data Residency

Availability Zones and a paired region within the same data residency boundary provides high availability, disaster recovery, and backup.



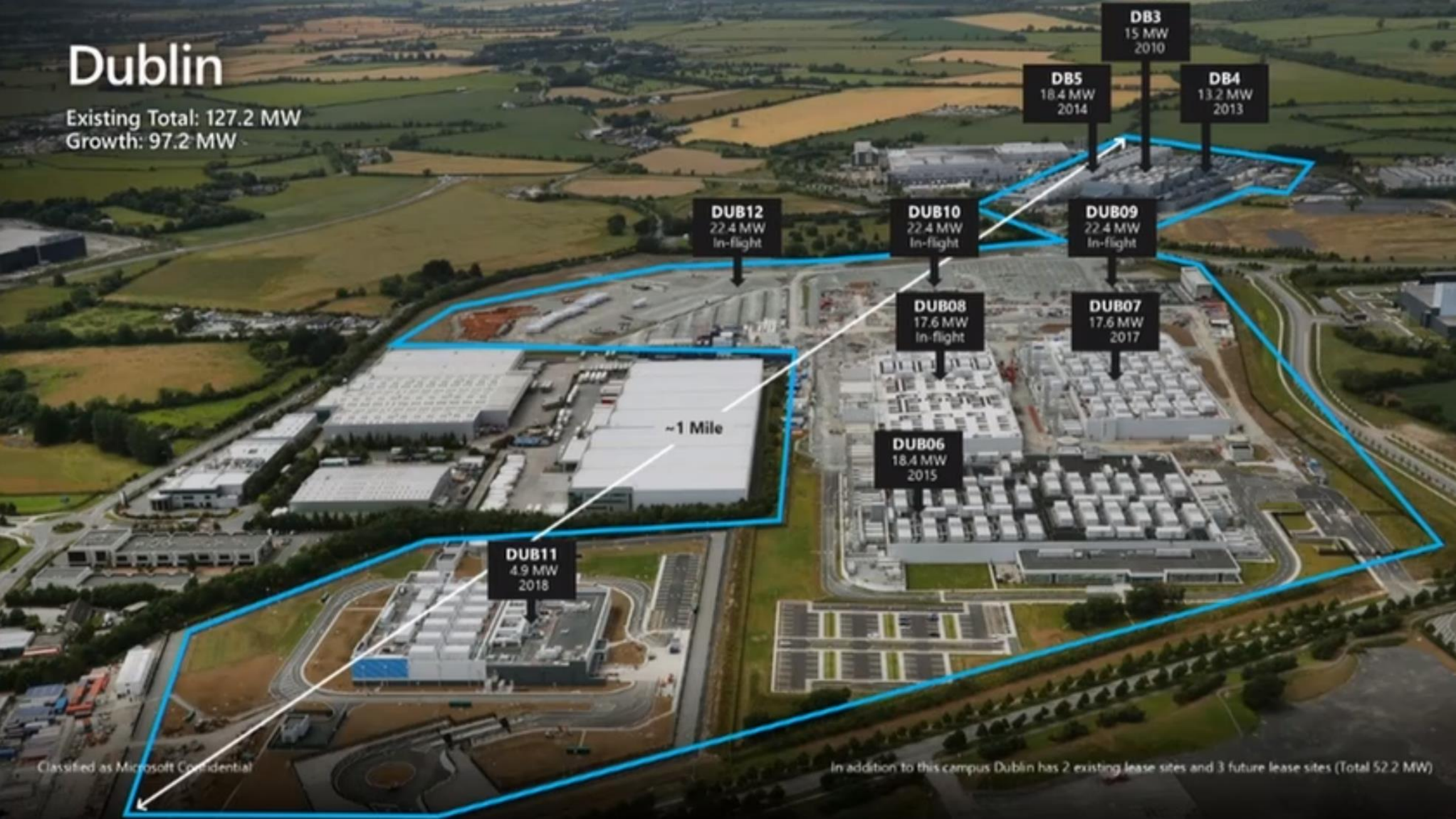
Protect against entire datacenter loss

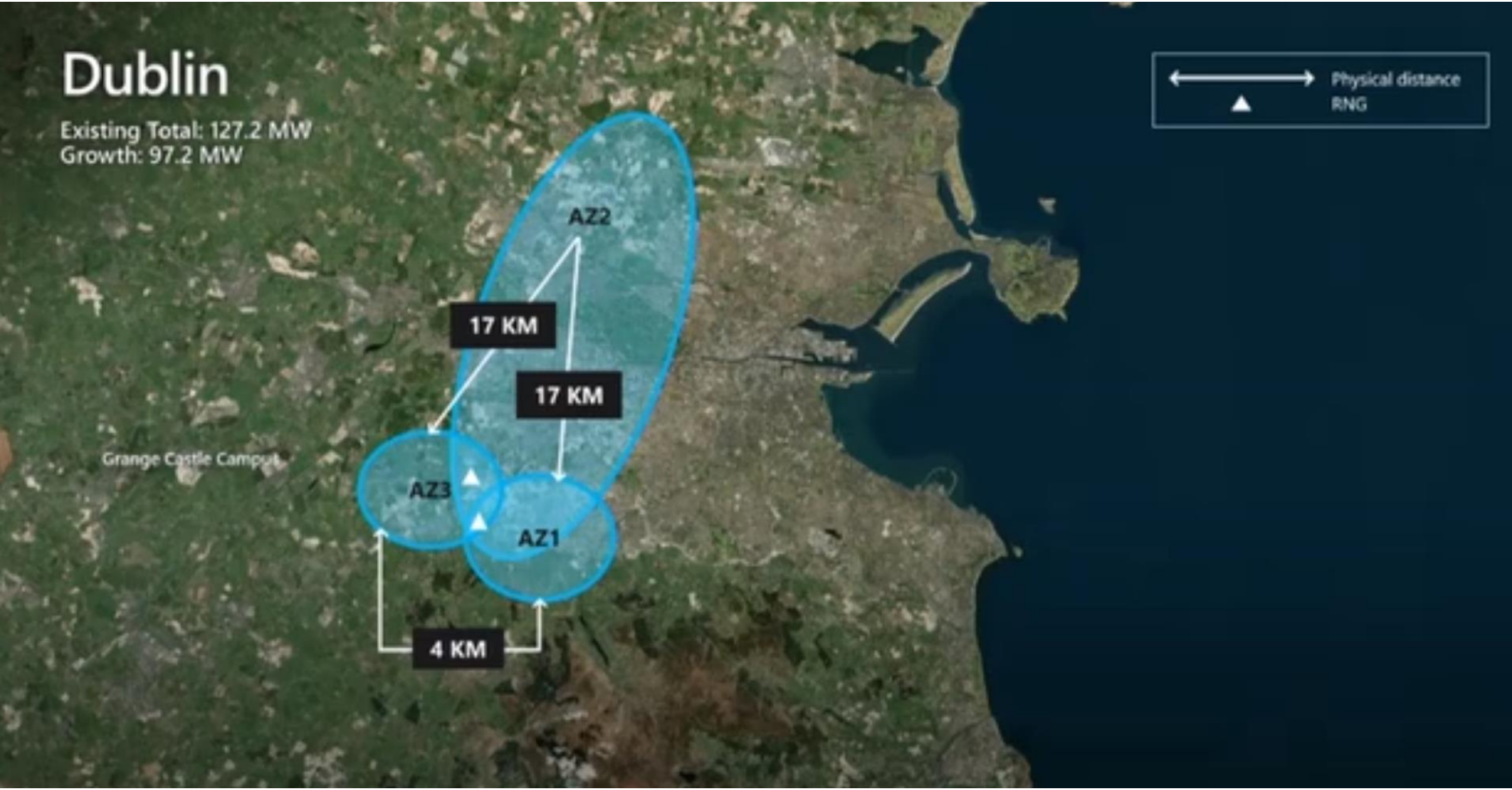
Each zone is physically separated and consists of one or more datacenters with independent power, network, and cooling. Applications and data are replicated through zone-redundant services.

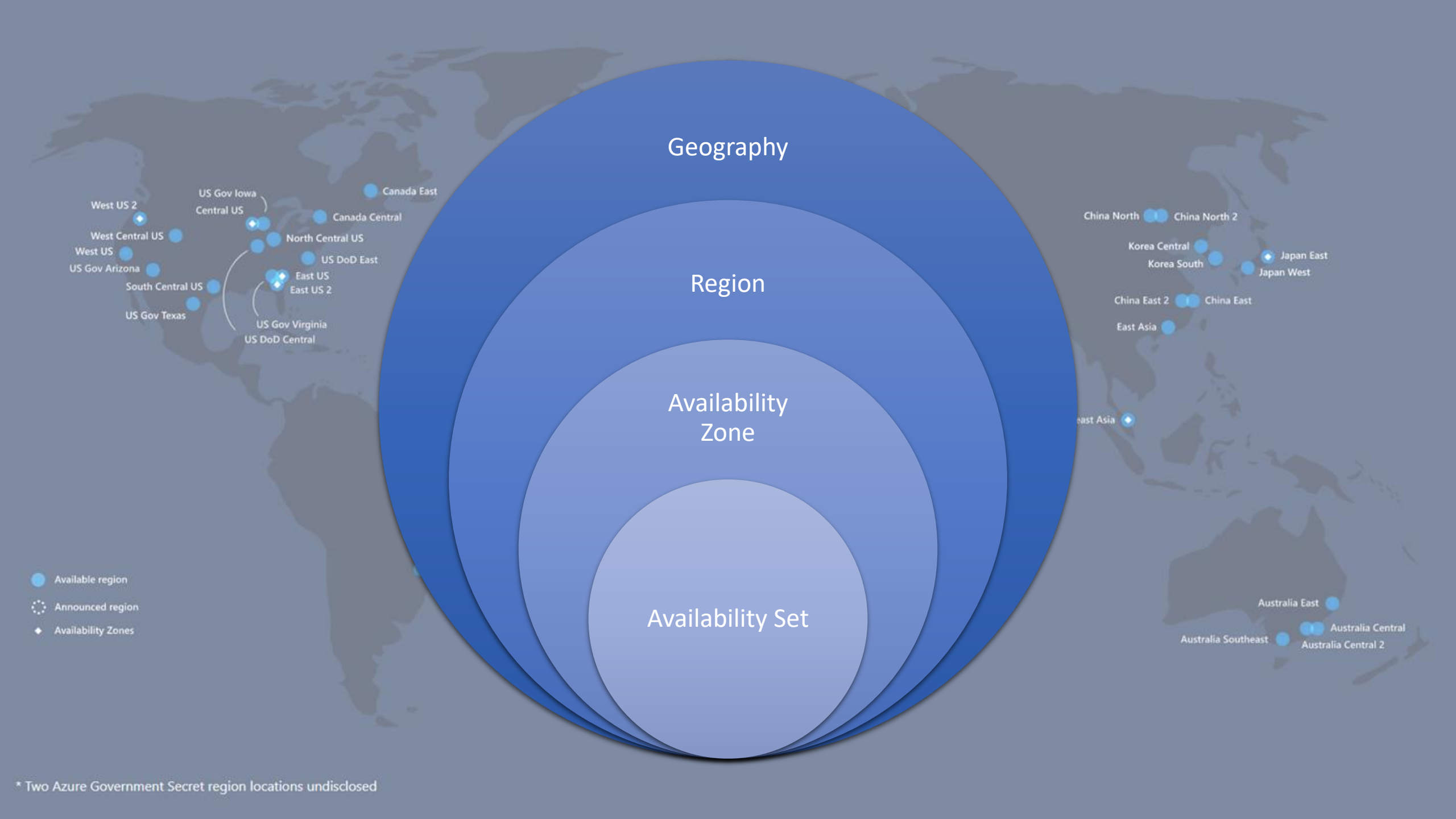


Run mission-critical applications with 99.99% SLA

High Availability supported with industry best SLA when two or more VMs are running in separate Availability Zones within a region.


Dublin
Existing Total: 127.2 MW
Growth: 97.2 MW
DB3
15 MW
2010
DB5
18.4 MW
2014
DB4
13.2 MW
2013
DUB12
22.4 MW
In-flight
DUB10
22.4 MW
In-flight
DUB09
22.4 MW
In-flight
DUB08
17.6 MW
In-flight
DUB07
17.6 MW
2017
DUB06
18.4 MW
2015
DUB11
4.9 MW
2018
~1 Mile
Classified as Microsoft Confidential
In addition to this campus Dublin has 2 existing lease sites and 3 future lease sites (Total 52.2 MW)


Dublin
Existing Total: 127.2 MW
Growth: 97.2 MW
Physical distance
RNG
AZ2
17 KM
17 KM
Grange Castle Campus
AZ3
AZ1
4 KM


Geography
Region
Availability Zone
Availability Set
West US 2
West Central US
West US
US Gov Arizona
US Gov Iowa
Central US
South Central US
US Gov Texas
Canada East
Canada Central
North Central US
US DoD East
East US
East US 2
US Gov Virginia
US DoD Central
China North
China North 2
Korea Central
Korea South
Japan East
Japan West
China East 2
China East
East Asia
Australia East
Australia Central
Australia Southeast
Australia Central 2
Available region
Announced region
Availability Zones
* Two Azure Government Secret region locations undisclosed

Types of failures you need Resilience from

Customer need

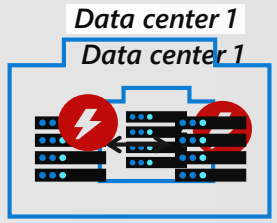
Improved availability

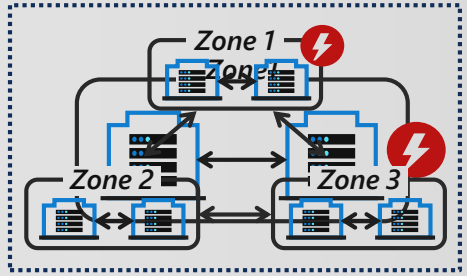
Build and run *highly available* applications with near zero RPO/RTO

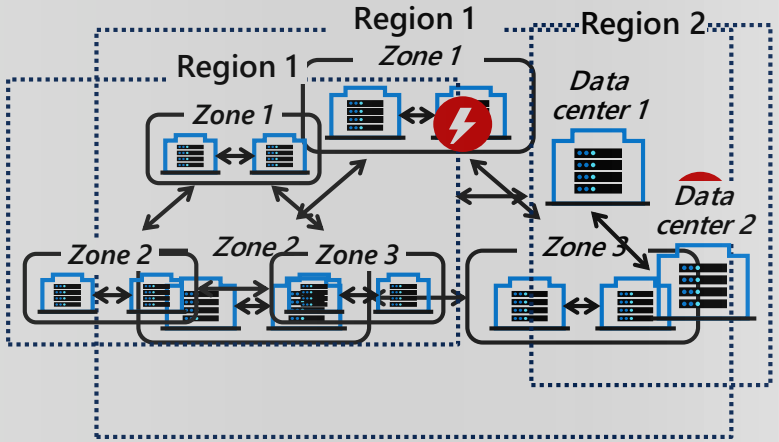
Implement *disaster recovery plan* with data residency and minimal RPO/RTO

Premium Storage	Availability Sets	Availability Zones	Azure Site Recovery & Region Pairs

Host Infrastructure







SLA 99.9%

Hardware failure

SLA 99.95%

Rack level failure

SLA 99.99%

Datacenter outage

RTO 30 minutes

Natural Disaster

Scope of impact

Data

Accidental data loss

Data corruption

Ransomware

Go back to *point-in-time* to *restore* the healthy version of data

Backup

Microsoft

Azure Compute

Compute:

Compute commonly refers to the collection of cloud computing resources that your application can run on

Azure Compute: Capabilities & Features

Compute

Customer Needs

- Lift and shift" of legacy systems into a fully automated infrastructure
- Scale out and scale up capabilities
- Global scale
- Third party line of business applications such as SAP HANA

Designed for high-end workloads

- Virtual Machines
- Virtual Machine Scale Sets
- Disks
- Availability Sets

Compute options for all apps

- Intel Haswell E5-2673 v3, Lowest cost, flexible CPUs Up to 8vCPUs, 32GB RAM
- Intel Broadwell E5-2673 v4 Hyper-Threaded CPUs Up to 64 vCPU's, 256GB RAM
- Intel® Xeon® Platinum 8168 processor (Skylake)
- AMD EPYC™7551 processor 8x1.9 TB SSDs
- Intel Xeon E5-2673 v4 (Broadwell) , Hyper-Threaded CPUs. Up to 64 vCPUs, 432GB RAM
- Intel Xeon E7-8890 v3 (Haswell). Largest VMs in Azure. Up to 128 vCPUs, 4TB RAM
- Nvidia GPU accelerated compute and Graphics platform featuring Nvidia GRID 2.0 on M60. Tesla P40, P100 and V100 for AI/ML and HPC workloads.
- SkyLake Processor - The F-series is hyper-threaded and based on the Intel Xeon® Platinum 8168 (SkyLake) processor

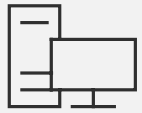
Compute Options

Entry level	Burstable	General Purpose	Compute Optimized	Storage Optimized	Memory Optimized	GPU Enabled	High Performance Computing	Purpose-built Infrastructure
Av2	B	D	F	L	Ev3	NC	H	SAP HANA
		Dv2	Fv2	Lv2	Dv3	NCv2	HB	
		Dv3			M	NCv3	HC	
		DC				NV		
						NVv2		
						ND		
						NDv2		

Most comprehensive resiliency and best SLA

INDUSTRY-ONLY

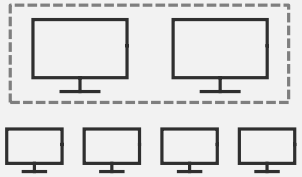
VM SLA
99.9%



SINGLE VM
Protection with Premium Storage

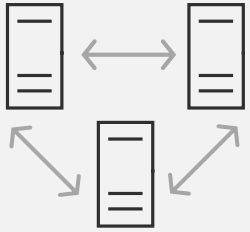
INDUSTRY-LEADING HIGH AVAILABILITY SLA

VM SLA
99.95%



AVAILABILITY SETS
Protection against failures within datacenters

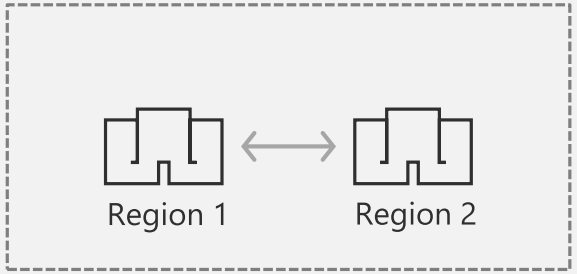
VM SLA
99.99%



AVAILABILITY ZONES
Protection from entire datacenter failures

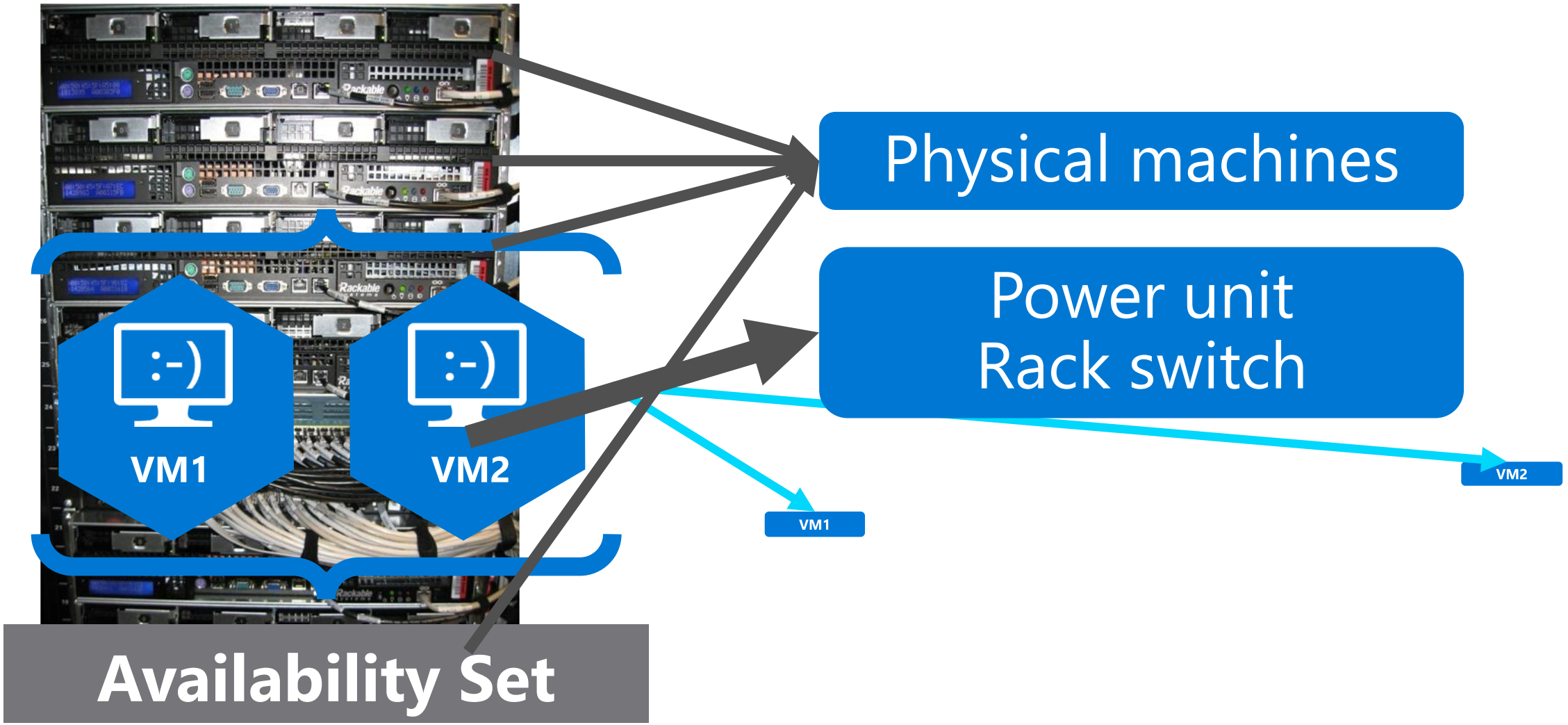
INDUSTRY-LEADING DISASTER RECOVERY

REGIONS
54



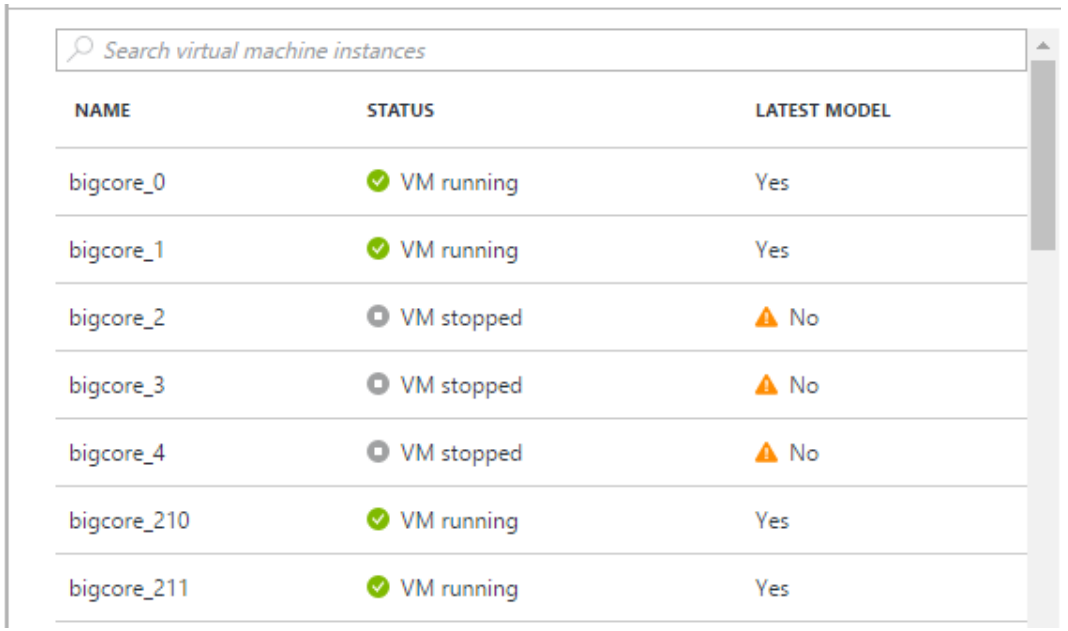
REGION PAIRS
Protection from disaster with Data Residency compliance

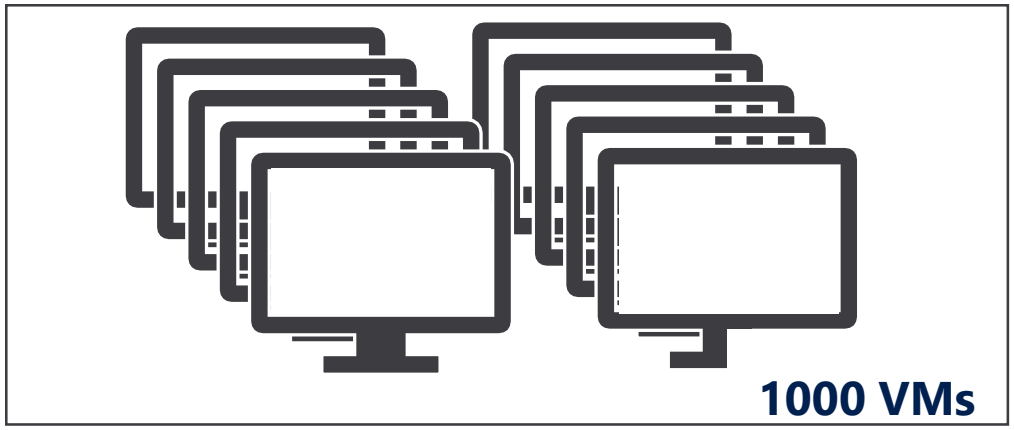
Availability Sets



Virtual Machine Scale Sets (VMSS)

- Scale - Deploy identical resources
  - Easily
  - Rapidly
  - At scale….10s – 10,000s of cores
- Customization – PaaS-like ease of use with custom infrastructure requirements
- Availability - Roll out updates without service interruption
- Low cost - Dynamically increase/decrease compute power to optimize costs
- Elasticity - Automatically scale to changing demand



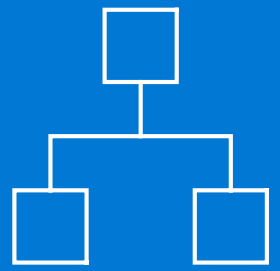


https://azure.microsoft.com/en-us/documentation/services/virtual-machines-scale-sets/

Microsoft

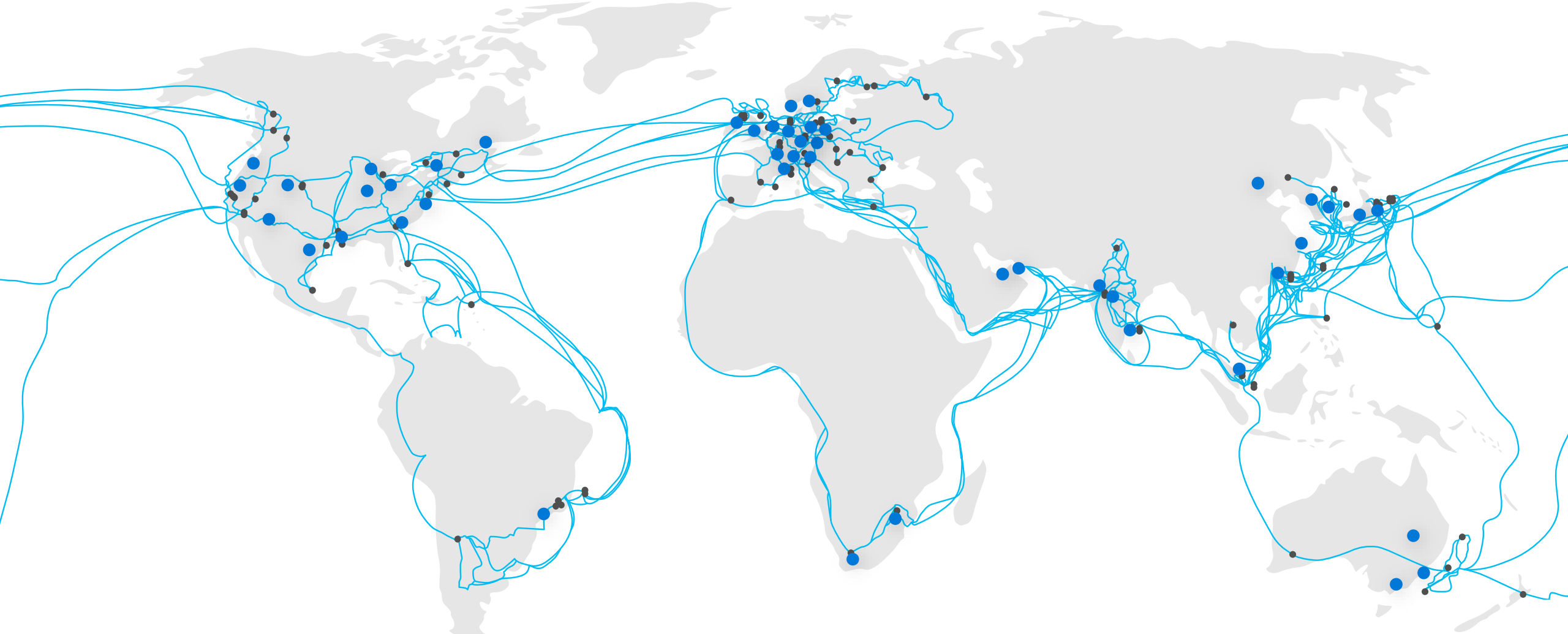
Azure Networking

Networking



Allows you to easily provision private networks, securely connecting users to cloud applications, and to your on-premises datacenters

Gain global scale with local presence



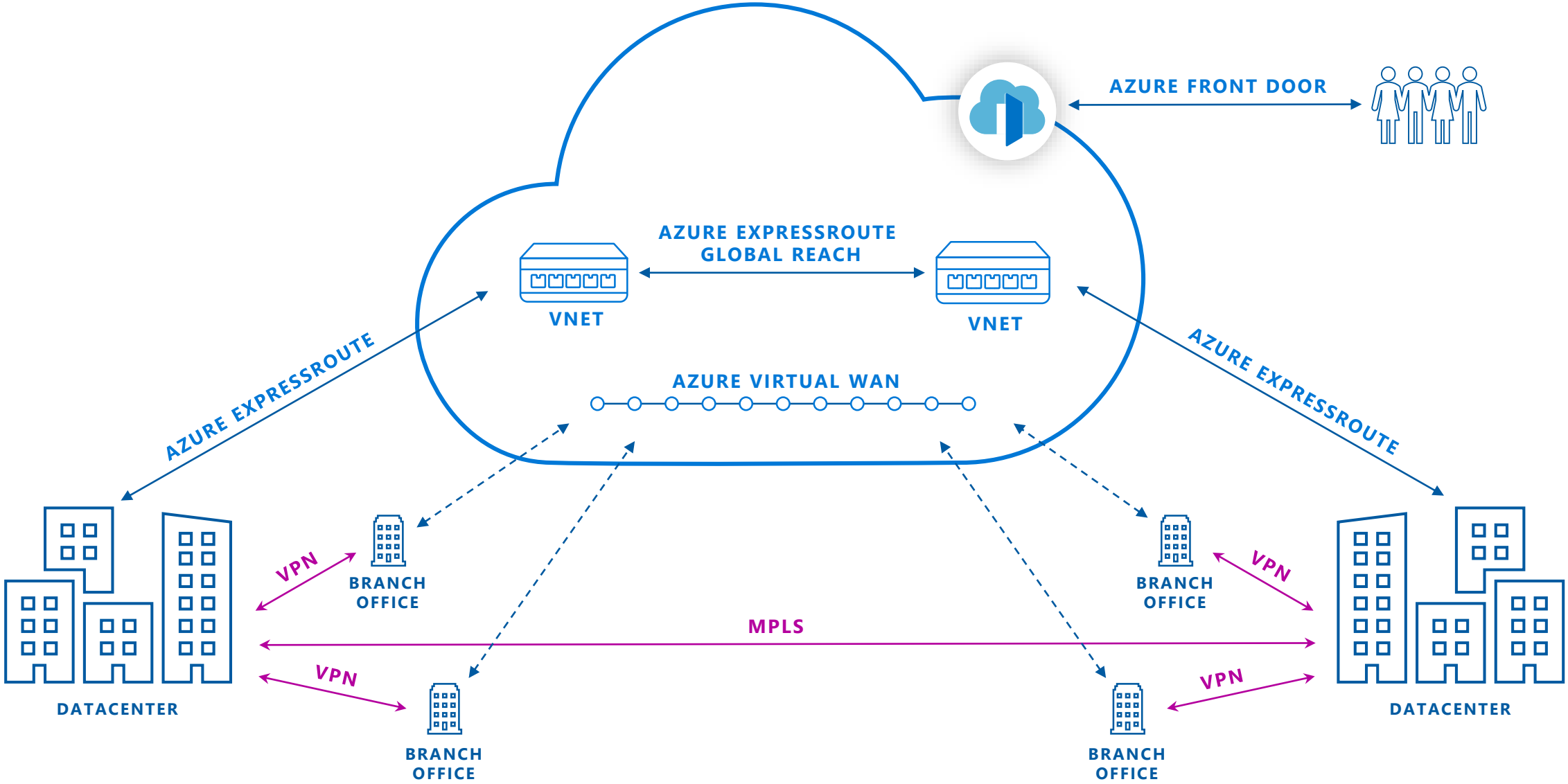
54 REGIONS WORLDWIDE

100K+ MILES OF FIBER AND SUBSEA CABLE

135+ EDGE SITES

200+ EXPRESSROUTE PARTNERS

Fast, most flexible hybrid connectivity and app delivery



Azure region to region round trip latency

The inter-region average latency measurements on a monthly basis

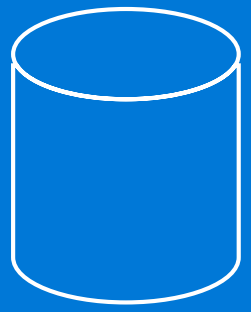
Full Report:
https://docs.microsoft.com/en-us/azure/networking/azure-network-latency

ThousandEyes

	Australia Central	Australia East	Australia South East	Brazil South	Canada Central	Canada East	Central India	Central US	East Asia	East US	East US2	France Central	France South	Germany North	Germany West Central	Japan East	Japan West
Australia Central		7	18	317	221	231	155	202	124	210	205	285	299	300	294	110	118
Australia East	7		13	311	215	225	149	196	118	204	199	279	293	293	288	108	114
Australia South East	18	13		321	226	235	149	206	122	215	210	289	304	304	299	118	125
Brazil South	317	311	321		131	141	303	145	321	118	122	186	200	197	192	261	268
Canada Central	221	215	226	131		12	208	21	197	25	29	92	107	104	99	153	161
Canada East	231	225	235	141	12		217	30	207	34	38	102	117	114	108	163	170
Central India	155	149	149	303	208	217		223	95	196	197	117	104	128	120	128	134
Central US	202	196	206	145	21	30	223		177	29	35	107	114	118	113	133	140
East Asia	124	118	122	321	197	207	95	177		204	210	214	201	227	219	52	50
East US	210	204	215	118	25	34	196	29	204		5	80	90	91	86	168	168
East US2	205	199	210	122	29	38	197	35	210	5		80	90	95	90	164	164
France Central	285	279	289	186	92	102	117	107	214	80	80		11	20	9	248	252
France South	299	293	304	200	107	117	104	114	201	90	90	11		26	17	235	242

Microsoft

Azure Storage



Storage

Azure provides a unified distributed storage system offering durability, **encryption at rest**, strongly consistent **replication**, and auto load-balancing

Azure storage portfolio

Secure, massively scalable cloud storage for every use case

Disk Storage

Ultra, Premium SSD, Standard SDD, Standard HDD

Reliable, persistent, high performing storage for Virtual Machines

File Storage

Azure Files

Azure NetApp Files

Secure, high performance cloud file shares

Hybrid/Edge Storage

Azure File Sync, Avere, Azure DataBox Edge

Secure, intelligent data tiering between on-premises and cloud storage

Data Transport

Azure DataBox

Classic, Heavy, Disk

Move or migrate data into Azure

Object Storage

Azure Blobs

Azure Data Lake Storage Gen 2

Secure, scalable storage for unstructured data and high performance HDFS

Virtual Machine Disk Storage

Virtual Machine OS and Data Disks exist within Azure Storage service

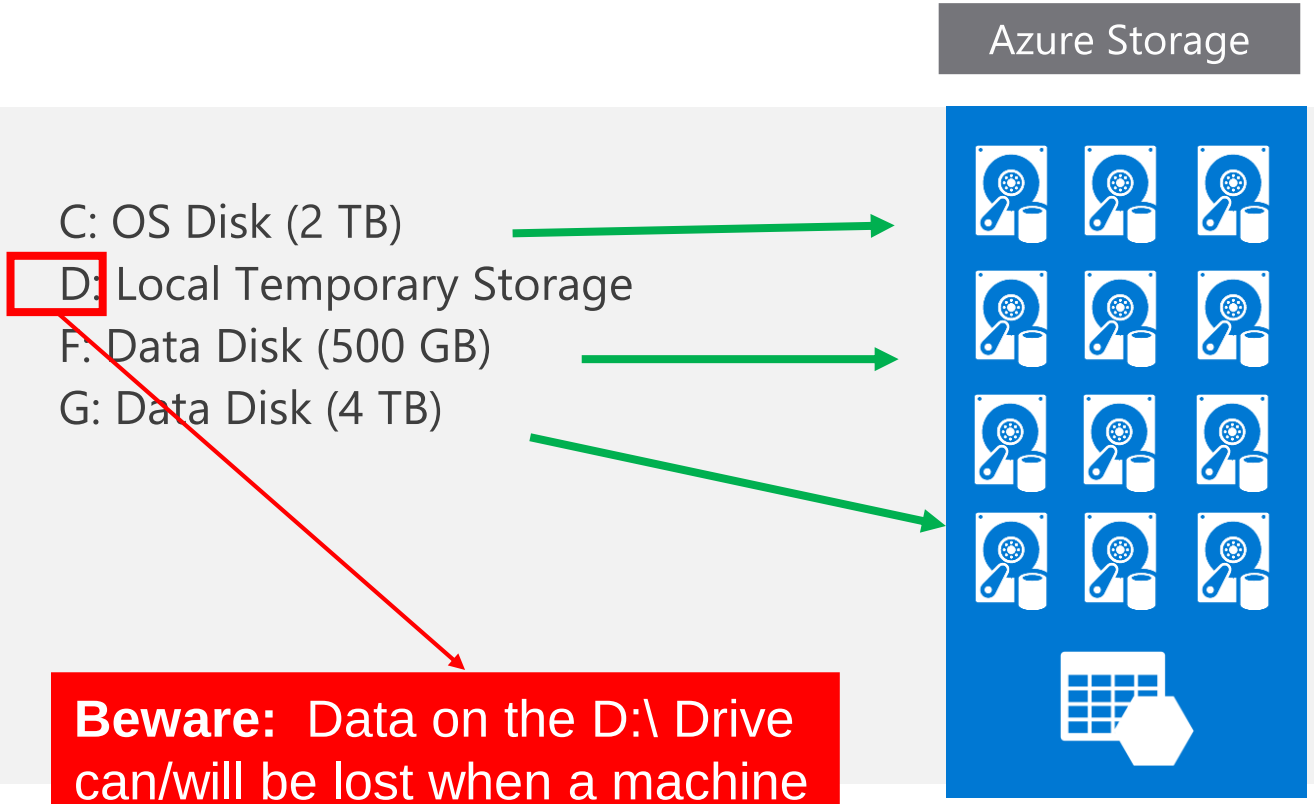
Disks

- Resource or temporary disk exists in hypervisor local storage
- Additional disks are then added based on VM size
- You can mix Standard and Premium disks if required

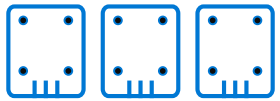
Virtual Machine Disk Storage

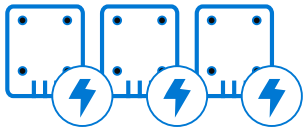
Virtual Machine OS and Data Disks exist within Azure Storage service

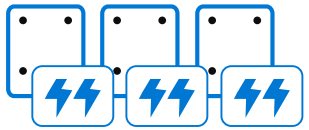
- Resource or temporary disk exists in hypervisor local storage
- Additional disks are then added based on VM size
- You can mix Standard and Premium disks if required



Azure Disk Portfolio & Performance







NEW !

Single disk max value	Standard HDD	Standard SSD	Premium SSD	Ultra Disk
Workloads	Backups, low end file server	Big Data, entry-level Web Servers	Databases, enterprise production, container volumes	SAP HANA, SAN, Tier-1 workloads
Tier	Low-cost storage	Consistent performance	High performance	Sub-millisecond latency
Size	32 TiB	32 TiB	32 TiB	64 TiB
IOPS	2,000	6,000	20,000	160,000
Bandwidth	500 MBps	750 MBps	900 MBps	2,000 MBps

NEW !

General Availability	
	• New disk sizes (8, 16 and 32 TiB). Premium SSDs can now scale up to Up to 32 TiB, 20000 IOPS and 900 MBps (March 2019). • Azure Ultra Disk Storage delivers unprecedented and extremely scalable performance with sub-millisecond latency (August 2019)

http://aka.ms/azuredisks

Data Redundancy

- Locally redundant storage (LRS)
  - replicates your data three times within a single data center
  - provides at least 99.999999999% (11 nines) durability of objects over a given year
  - lowest-cost replication option and offers the least durability compared to other options
- Zone-redundant storage (ZRS)
  - replicates your data synchronously across three storage clusters in a single region
  - each storage cluster is physically separated from the others and is located in its own availability zone (AZ)
  - each availability zone—and the ZRS cluster within it—is autonomous and includes separate utilities and networking features
  - A write request to a ZRS storage account returns successfully only after the data is written to all replicas across the three clusters.

Data Redundancy (Cont.)

- Geo-redundant storage (GRS)
  - designed to provide at least 99.99999999999999% (16 9's) durability of objects over a given year
  - replicates your data to a secondary region that is hundreds of miles away from the primary region
  - if your storage account has GRS enabled, then your data is durable even in the case of a complete regional outage or a disaster in which the primary region isn't recoverable.
- Read-access geo-redundant storage (RA-GRS)
  - replicates your data to another data center in a secondary region and provides you with the option to read from the secondary region.
  - you can read from the secondary region regardless of whether Microsoft initiates a failover from the primary to secondary region.

Data Redundancy (Cont.)

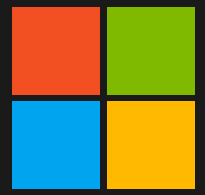
- Geo-zone-redundant storage (GZRS) (preview)
  - Marries the high availability of zone-redundant storage (ZRS) with protection from regional outages as provided by geo-redundant storage (GRS).
  - Data in a GZRS storage account is replicated across three Azure availability zones in the primary region and replicated to a secondary geographic region for protection from regional disasters.
  - Each Azure region is paired with another region within the same geography, together making a regional pair. For more details and exceptions refer to the documentation.
  - You can continue to read and write data if an availability zone becomes unavailable or is unrecoverable.
  - Designed to provide at least 99.9999999999999% (16 9's) durability of objects over a given year.

Access Tiers

- Hot
  - Optimized for storing data that is accessed frequently.
- Cool
  - Optimized for storing data that is infrequently accessed and stored for at least 30 days.
- Archive
  - Optimized for storing data that is rarely accessed and stored for at least 180 days with flexible latency requirements (on the order of hours).

Tiers can be mixed. Refer to the following for guidance https://docs.microsoft.com/en-us/azure/storage/blobs/storage-blob-storage-tiers#comparing-block-blob-storage-options


High Availability
Disaster Recovery
Scalability
Global Reach
Elasticity
Up-to-date
Agility
Cost Effective
Fault Tolerance
Security



Microsoft Azure

Productive + Hybrid + Intelligent + Trusted